2006
TRAINING MANUAL
FOR
LANDFILL OPERATORS
&
MANAGERS

Prepared for:

Environmental and Public Protection Cabinet

KY Department of Environmental Protection

Division of Waste Management

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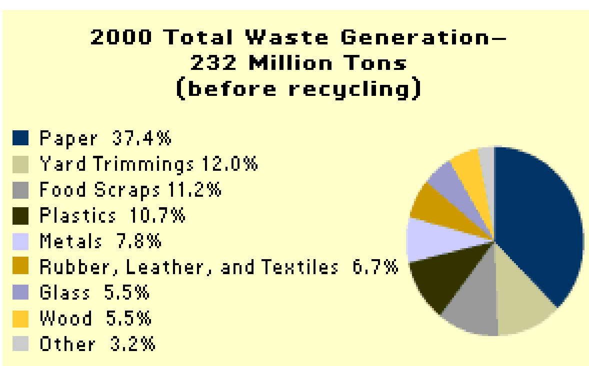
CHAPTER 1
WASTE MANAGEMENT IN KENTUCKY

This section explains why and how solid waste is managed in Kentucky and discusses the roles of those involved in disposal.

WASTE GENERATION AND CHARACTERISTICS

Kentucky citizens currently generate over 5 million tons of solid waste annually. Each person produces over 1,400 pounds per year or approximately 3 to 4 pounds per day. The amount of waste produced continues to increase each year.

Commercial and industrial firms also produce solid waste. Each type of business produces a different amount and type of waste. A rate of 4.7 pounds per person per day disposed in contained landfills only is used by the Division of Waste Management (here after the Division) to estimate the amount of commercial and industrial waste generated in Kentucky. Some wastes may be disposed of at landfills. Other wastes may require another disposal method.



Nationwide, the Environmental Protection Agency (EPA) reports that In 1999, U.S. residents, businesses, and institutions produced more than 230 million tons of MSW, which is approximately 4.6 pounds of waste per person per day, up from 2.7 pounds per person per day in 1960.

In Kentucky, waste is classified as either solid waste or hazardous waste. **Solid waste** is any garbage, refuse, sludge, or other discarded material. **Hazardous waste** is material that, because of its characteristics, quantities, or concentrations, may present a hazard to human health or the environment when improperly disposed.

Landfill operators must have a thorough working knowledge of various waste streams since not all wastes may be accepted at a landfill. A variety of waste streams may be accepted at a landfill; however, some of these waste streams may require unique handling methods. The Waste Streams and Handling Section of this manual explains waste streams in detail.

NEED FOR PROPER MANAGEMENT

Over the years, the lack of comprehensive waste management systems has allowed thousands of open dumps to be created across the state. It is estimated that over 450 thousand tons of waste are disposed of illegally in Kentucky each year. Illegal dumping results from low collection rates and the publics misunderstanding of the effect illegal disposal has on public health and the environment.

Open dumps are breeding grounds for disease vectors such as rats, flies, fleas, mosquitoes, and birds which carry and transmit pathogens creating potential health hazards. Twenty-two (22) human diseases have been traced to improper solid waste management.

In addition to the direct health impacts of open dumps, communities may face impacts from:

- lowered community's self esteem and property values,
- contaminated drinking water supplies,
- safety hazards (accident rate for sanitary workers is 4 1/2 times greater than the next most hazardous industry - coal mining),
- odors and methane gas from decaying vegetation and garbage,
- land removed from other productive uses (wildlife habitat, residential, etc.),
- increase threat of forest fires (open dumps are a major cause),
- direct costs to property owners and public agencies for cleanup (During the 1998-1999 fiscal year the state highway department collected more than 96,000 bags of roadside litter, which took a total of 215,670 man hours at a cost of $3,961,000 for roadside litter cleanup alone), and
- reduction of a stream's carrying capacity resulting in increased flood heights during storms.

Waste generated by our communities must be stored, collected, and disposed of properly to protect public health and the environment. Good management practices will also minimize the economic and social costs associated with indiscriminate dumping. HB 174 will provide Kentucky counties with the opportunity to receive funding for cleanup of illegal dumps. See following section for summary of HB 174 as passed.

SUMMARY OF HB 174

HB 174, as passed:

- Establishes priorities for proper solid waste management in Kentucky through waste reduction, recycling, proper closure of abandoned landfills, education, proper collection and disposal of solid waste, elimination of illegal open dumps and abatement of litter.

- Identifies counties as being in best position to plan for solid waste collection, with technical and financial assistance from the state.

- Creates revenue to begin to address some of the priority issues: abandoned landfills, illegal dumps and litter.

- Revenue will be generated through; $25 million bond sale, $1.75 environmental fee assessed on each ton of waste disposed in municipal solid waste disposal facilities, and $5 million annual transfer from highway road and contingency funds.

- Kentucky Pride Fund established to receive funds, which will be administered by the Environmental and Public Protection Cabinet.

- $1.75 environmental fee on waste disposed at municipal solid waste disposal facilities to be collected at transfer stations or contained landfills in the Commonwealth.

- Cabinet to develop regulations with a formula for estimating tons of waste at transfer stations without scales. Notice of Intent published July 1, 2002, with NOI public hearing on July 30, 2002. Draft regulation filed November 1, 2002 for 30-day public comment period.

- Revenue generated from all sources expected to be approximately $32.5 million in first year (FY 03), and $14.8 million in ongoing revenue for the following years.

- The $25 million dollar bond and $5 million from the environmental fee to be used by the Cabinet for the identification and closure of abandoned landfills, as well paying debt service on the bond.
  Bond can only be issued upon approval of state budget.

- Interest on Pride Fund, up to $1 million, will fund Kentucky Environmental Education Master Plan.

- The remaining environmental fee revenues and road fund monies (expected to be $9.8 million annually) are to be used by the counties and cities for the cleanup of illegal dumps and litter.

- Counties and cities will receive litter monies based on their population and road miles.

- Counties must clean roadsides three (3) times a year, and cities must clean city streets two (2) times a year.

- Cabinet will prioritize illegal dumps based on health and environmental risk in first year.

- Cabinet will reimburse counties for illegal dump cleanup, with county providing 25% match.

- Counties must have approved solid waste management plan to receive reimbursement.

- Requires counties to have a solid waste coordinator with enforcement powers.

- Gives solid waste coordinators additional authority to issue citations for illegal dumping and littering.

- Requires waste haulers and recyclers to register and report to counties in which they operate.

- Suspends until July, 2006, Cabinet enforcement actions against counties and cities regarding abandoned landfill closure.

- Cabinet must present a plan to legislature by December ’04 for closure of remaining abandoned landfills, with recommendations for funding.

MANAGEMENT PRACTICES

Solid waste requires both short and long term management by local and state agencies as well as private industry. Management practices include:

- landfilling,
- local solid waste management plans,
- source reduction,
- recycling,
- collection,
- incineration,
- resource recovery, and
- public education.

SOLID WASTE MANAGEMENT PLANNING

KRS 224.40-315 requires counties to develop and implement a solid waste management plan that shall be updated every five years. The first five year plan for each county began in 1992; the second five year plans are effective for the period of 1998-2002. The governing body, in most instances the fiscal court of a county, is responsible for implementing the solid waste management plan, submitting a completed annual report and responding to local determination requests.

Each plan must address the following components and demonstrate the tasks the county will implement for each component on an annual basis:

- collection of municipal solid waste,
- disposal,
- recycling/reduction,
- cleanup of litter and open dumps,
- enforcement of local and state laws regarding solid waste management,
- siting of solid waste management facilities, and
- educational efforts for schools and the public at large for all components.

SOURCE REDUCTION

Source reduction is normally practiced at the corporate level to reduce the amount of waste having to be managed. An example of source reduction would be for a manufacturer to eliminate extra packaging around their products, design the product to be more durable (e.g., refillable lighters vs. disposal lighters), or to eliminate a toxic chemical from the manufacturing process. This slows the depletion of natural resources, prolongs the life of disposal facilities, and can make incineration and landfilling safer by removing toxins. While local waste handlers do not use source reduction for managing waste that is collected, it is a technique everyone can promote through selective buying habits (purchasing products which can be recycled).

Using 1993 as a baseline year, the 1991 Kentucky General Assembly passed legislation aimed at reducing the amount of waste going to Kentucky landfills by 25 percent. This goal was to be met by 1997; however, because of the increased collection of solid waste and the initiative to cleanup open dumps across the state this goal has not been met. This initiative identified literally thousands of open dumps located across the state. In turn, this has led to a massive cleanup that still continues today.

RECYCLING

Recycling is the separation of a given waste material (e.g., glass, plastic, aluminum, etc.) from the waste stream and processing it to be used again as a raw material. Recycling can also be viewed as a profit making venture, an avoided disposal cost, and/or a way of preventing potentially useful materials from being burned or buried. Operators are familiar with the types and quantities of waste placed in the working face. This provides the landfill's management and operators with the opportunity to identify large amounts of similar wastes (e.g., wood pallets, slightly damaged products, tires, etc.), separate out these items, and sell them or recommend to the generator that they be removed from the waste stream.

COLLECTION

One of the major goals in development of a solid waste management plan is to increase residential collection. Rural collection is low in many counties, but gains are being made as a result of increased attention to the problem. In 1983, door-to-door collection was available to two-thirds of Kentucky's residents by 1985, collection was made available to 73 percent of the residents. 120 counties have now implemented universal collection systems. This means that access for collection of waste is available to all citizens. Currently 26 counties have mandatory collection of their solid waste.

Types of door-to-door collection systems include:

- private haulers,
- permit haulers,
- franchise haulers,
- municipally owned systems, and
- can include staffed convenience centers or transfer stations

Door-to-door collection systems utilized by counties are defined as follows:

- Private hauler - No permit required; hauler may provide service throughout the area.
- Permit Local - Government requires haulers to obtain a permit in order to operate in the county. Permit haulers may also provide service throughout the county.
- Franchise - The county awards a franchise to hauler(s) based on a winning bid. Franchise areas can include one or more designated areas of a county.
- Municipal - A collection system that is owned and operated by county government.
- Convenience Centers/Transfer Stations - Can be used as a direct haul collection system in conjunction with any of the preceding collection systems or can be used as the only system.

Universal collection is defined as "a municipal solid waste collection system that is established by ordinance, is approved by the Environmental and Public Protection Cabinet (Cabinet) and requires access for each household or solid waste generator in a county."

INCINERATION (TREATMENT)

Incineration is the controlled burning of waste in an engineered structure and is useful in reducing the bulk associated with solid waste. Although not risk free, a state-of-the-art incinerator that is well operated should not present a risk to human health and the environment. The Cabinet's Division for Air Quality and Division of Waste Management regulate incinerators. Residual ash from incinerators is regulated by the Division of Waste Management and must be disposed of at a permitted contained landfill.

RESOURCE RECOVERY (TREATMENT)

Resource recovery is a treatment process in which the energy produced (heat) from burning the waste is used to produce steam for heating or the production of electricity. The permitting is identical to incineration. Resource recovery has not yet become a viable alternative for waste management in Kentucky. Waste-to-energy projects are often unable to compete economically with landfill operations for the following reasons:

- capital cost (minimum of $3.5 million for a 50 ton per day plant),
- lack of long term secure markets for energy produced,
- low population,
- incomplete collection systems, and
- the low market price for coal which has about the same BTU value.

TDF (Tire Disposal Facility): Kentucky generates 5 million tires per year. One utility in western Kentucky is burning tire fuel, or chipped tires. This used 1 million tires per year. Two more potential sites in northeast Kentucky would use the rest of the scrap tires. The permitting is the same as incineration and resource recovery.

LANDFILLING (DISPOSAL)

The so1id waste management program was initiated by Kentucky in 1968 and permits for disposal were issued shortly thereafter. In 1983, Kentucky had 97 landfills, however, due to noncompliance with state regulations and exhaustion of landfill space, the state now has only 27 contained landfills that will accept Municipal Solid Waste (MSW). These numbers are subject to change due to changes in permit status and new permit applications. The siting of new landfills is difficult in Kentucky due to:

- karst terrain,
- high rainfall,
- high groundwater,
- steep terrain, and
- public opposition

Landfills will continue to be the primary method of solid waste disposal for the foreseeable future. Kentucky currently depends 100 percent on land disposal of its solid waste. While recycling, resource recovery, and incineration of solid wastes will reduce the volume of waste, landfills will still be needed for disposal of incinerator and resource recovery ash and waste not diverted from the process. The increasing cost of landfill construction and operation will encourage the development of larger landfills to meet multi-county and regional needs.

PUBLIC EDUCATION

There is a great need for public education regarding solid waste issues. However, public education usually suffers the first cuts during tight budget periods and is most often written into the planning process as an afterthought or luxury item. Public education activities are essential to effective solid waste management. Therefore, this issue has become an integral part of the training and technical assistance rendered by the Cabinet.

The Cabinet is involved in many activities that foster public education. Public education involves the distribution of information and delivery of presentations along with other one-way communication to the public. These activities include technical assistance, networking with other state agencies, production of bulletins and newsletters, clean community programs, and special presentations.

KENTUCKY REGULATIONS

In the late 1980s, waste management issues became a public focal point in Kentucky and across the nation. Faced with pending federal Subtitle D criteria, increased usage of Kentucky landfills by northern states, new scientific and empirical data on solid waste management facilities and increased public concern, the Division drafted new solid waste management regulations. The regulations found in 401 KAR Chapters 30, 47, 48, and 49, address solid waste planning requirements, design, and operational standards applicable to all solid waste sites or facilities.

ENVIRONMENTAL PERFORMANCE STANDARDS

The Environmental Performance Standards (401 KAR 47:030) outline the minimum requirements to assure disposal sites or facilities do not pose an unreasonable risk or adverse effect on human health or the environment. The rule is similar to 40CFR257, which was promulgated by the U.S. EPA. All solid waste management facilities in Kentucky must demonstrate compliance with these standards. Sites failing to meet these standards are considered open dumps, which are prohibited by law. The Environmental Performance Standards (EPS) are categorized by site selection, landfill operation, and safety.

SITE SELECTION STANDARDS

- **Floodplain control** -A waste disposa1 site cannot be located in a floodway, restrict the flow of the 100 year flood, reduce the water storage capacity of the floodplain, or result in the washout of waste. A contained landfill cannot be constructed in the l00 year floodplain.
- **Water pollution control** - The site cannot contaminate ground water sources within 250 feet of the waste boundary in excess of the maximum contaminant levels identified in 401 KAR 47:030. The site may not discharge to surface waters without a KPDES permit.
- **Groundwater protection** - A facility must have more than 4 feet of compacted earth between the bottom of the landfill and the seasonal high water table or bedrock.
- **Endangered plants and animals** - A facility cannot be located where any federally protected endangered plants, fish, wildlife or their habitat would be threatened.

LANDFILL OPERATIONAL STANDARDS

- Disease vector controls - flies, rats, birds, and mosquitoes must be controlled through the application of daily cover material or other techniques.
- Open burning and violation of applicable air pollution requirements (KRS 224 and 401 KAR Chapters 40 to 63) are prohibited.
- Owners or operators must control liter.

SAFETY STANDARDS

Public access control, specified methane gas limits, a contingency control plan, required fire control, a communications plan, and application of cover material are all components of a landfill's basic safety plan.

LANDFILL/PERMIT CATEGORIES

The following section outlines the solid waste permit types, which are classified, based on the waste managed and facility type.

A sanitary landfill is a solid waste facility permitted for the disposal of solid and non-regulated hazardous waste. Because of differences in waste types and disposal methods, solid waste disposal landfills are divided into 3 categories:

1. **Contained landfills** are facilities designed and permitted for the disposal of solid wastes including:

   - non-hazardous solid waste (residential, commercial, institutional, industrial and municipal waste),
   - shredded tires,
   - whole OTR (off-the-road) tires,
   - household hazardous waste,
   - limited quantity generator hazardous waste, and
   - non-hazardous spill clean-up residues.

   Technical requirements for contained landfills are found in 401 KAR 48:050 and 48:070 through 48:090.

2. **> 1 Acre Construction/Demolition/Debris (C/D/D) landfills** are facilities designed and permitted for the disposal of solid wastes including:

   - materials from the construction, remodeling, repair, or demolition of structures and roads (i.e., bricks, shredded tires, drywall, plumbing fixtures, paper products, furniture, shingles), and
   - vegetation from land clearing and grubbing, utility line maintenance, and seasonal and storm related cleanups (i.e., soil, tree stumps, sawdust, yard waste).

   Technical requirements for >1 Acre C/D/D landfills are found in 401 KAR 48:050 and 48:060.

3. **Residual landfills** are facilities designed and permitted for the disposal of specific solid waste(s) or residue(s), which can be fully characterized (i.e., has a limited number of hazardous constituents that a lab may identify and quantify). Special wastes, defined as low in hazard, high in volume, may also be disposed of in a residual landfill. Examples of residual wastes include:

   - industrial process waste,
   - utility wastes (i.e., fly ash and flue ash),
   - cement kiln dust, and
   - wastes from air and water pollution control devices.

Technical requirements for residual landfills are found in 401 KAR 48:050 and 48:170.

Residential and inert landfills are no longer recognized as landfill permit categories. Residential landfills had the option of converting to a contained or C/D/D landfill, provided relevant operating standards were met, or closed in accordance with 401 KAR 47:080, Section 5(1) before July 1, 1992. Inert landfills either converted to a C/D/D or residual landfill, provided relevant operating standards were met, or closed in accordance with 401 KAR 47:080, Section 5(3).

LANDFARMING AND COMPOSTING

Landfarming is a category of permit, which allows solid waste and special waste to be surface applied or injected into the upper layer of soil to improve soil quality or provide plant nutrients. Composting is a method of solid waste and special waste management whereby organic wastes are decomposed, in a controlled setting to produce a material that can be applied to supplement the soil. Technical requirements for the solid waste registered permit-by-rule category are found in 401 KAR 48:200. The technical requirements for special waste formal permits are found in 401 KAR Chapter 45.

Solid and special wastes suitable for landfarming or composting include:

Solid waste:

- food processing wastes and,
- yard waste.

Special waste:

- wastewater plant biosolids, and
- water plant sludge

PERMIT-BY-RULE

Certain classes of solid waste disposal sites or facilities are presumed to hold a permit without the owner submitting an application to the Cabinet. Because all waste disposal facilities must be permitted, the rule grants the authority to operate. The Division has incorporated the following 13 general permit categories.

- sawdust piles,
- asphalt residue,
- waste piles,

- Less than 100 tires, shredded tires occupying less than ¼ acre or tires used in farming operations,
- oil production related wastes,
- salvage yards,
- surface impoundments with a KPDES permit, and
- one-time disposal of waste construction or demolition material at the place of generation.
- When a permit-by-rule site is in known violation of the EPS, the permit-by-rule is revoked, the site is required to modify its operation to conform to the EPS and obtain a permit or close.

BENEFICIAL REUSE OF SOLID WASTE

Beneficial reuse of solid waste encompasses a one-time disposal of demolition wastes such as concrete slabs, brick, concrete block, or similar material, or coal ash and steel slag to provide structural inert support for buildings

REGISTERED PERMIT-BY-RULE

This category of solid waste sites or facilities requires the registration of certain types of management, processing, or disposal facilities. The purpose of this registration is to identify additional facilities for the management and measurement of Kentucky's waste stream.
Facilities that fall under this category include:

- < 1 Acre C/D/D landfills,
- recovered materials processing facility" in KRS 224.01-010
- transfer stations,
- solid waste incinerators with a design capacity of more than 1 ton per day,
- sludge giveaway programs,
- Class 1 landfarming sludges,
- septic tank pumpings, and
- convenience centers.

Registered Permit-by-Rule Facilities must submit a registration form to the Division, comply with the Environmental Performance Standards and applicable operating standards, and implement any necessary corrective action. New facilities must run a public notice and register prior to startup of operation. The owner/operator may begin operations 5 days after registration without a response by the cabinet. The department has 5 days to deny the registration for "bad actor" reasons. The owner/operator must operate accordingly or revise the registration.

OTHER PERMIT CATEGORIES

- **Emergency permits** are issued in accordance with 401 KAR 47:150 for the short term storage of solid waste generated in an emergency situation.

- **Research, development, and demonstration permits** are issued to facilities to demonstrate unproven technologies.

LANDFILLS AND PERSONNEL

All non-hazardous solid waste in Kentucky must be disposed of at a site permitted by the Cabinet's Solid Waste Branch, Division of Waste Management. Obtaining a permit and operating a solid waste site or facility requires a wide range of complex technical principles. Landfills are not abandoned holes in the ground to be filled with garbage. Constructing and operating a landfill involves budgets ranging from hundreds of thousands to millions of dollars and detailed engineering plans.

Proper management of a landfill requires the effort and cooperation of many people. In order for the permitted disposal system to achieve the goal of protecting human health and the environment, information must be exchanged among all individuals associated with the landfill. The following is a list of individuals, and their roles, involved in developing and operating a landfill.

APPLICANT

The applicant is the person who applies with the state agency for a solid waste site or facility permit. An applicant may be:

- an individual,
- government agency or subdivision (i.e., federal or state agency, fiscal court, KRS 109 Board, city council),
- company (i.e., corporation, partnership, firm), commission trust, or
- interstate body.

CONSULTANT

The engineer and geologist hired by the applicant to design the landfill must develop technical plans or drawings based on the geologic and hydrologic characteristics of the site that reflect, where applicable, local, state, and federal requirements. The engineer should be consulted during all phases (e.g. permitting, construction, operation and closure) of the site.

LOCAL GOVERNMENT

Counties are required to prepare and revise solid waste management plans as necessary. Permit applications must be consistent with these plans and local regulations or zoning ordinances.

FEDERAL GOVERNMENT

The permittee must comply with federal law including: The Wild and Scenic Rivers Act, The National Historic Preservation Act, The Endangered Species Act, The Fish and Wildlife Act, The Clean Air Act, and The Clean Water Act.

PERMIT REVIEWERS

The Division's permit reviewers include both engineers and geologists, who carefully check the contents of a landfill application to determine that the site meets regulatory requirements. A construction inspection, including testing, is also completed prior to issuing a permit.

INSPECTORS

Inspectors for the Division of Waste Management located in 10 offices throughout the state inspect each landfill approximately once per month to check the daily and long term operation. Inspections of the site are also completed prior to issuing a re-permit, or closure. A list of field offices and the counties they cover in the Appendix of this manual.

PERMIT HOLDER

Permits are issued in the name of the applicant. The permit holder may manage and operate the landfill or hire an individual(s) for these responsibilities. The permit cannot be transferred without written approval from the Division. If a landfill is sold or leased prior to closure, the successor is required to submit an application, and be financially responsible for closure.

LANDFILL MANAGER

The landfill manager is the individual with primary responsibility for management and operation of the site. Since the manager monitors the site to assure compliance with all permit conditions, the manager must have an understanding of the site's permit including the engineering plans. The manager makes long range decisions about the landfill and must communicate to the operator and permit holder the things that must be done to keep the landfill in compliance with applicable laws and regulations. This course will enable the manager to read and interpret the permit and provide guidance to both the landfill operator and permit holder.

STATE AGENCY

The Division of Waste Management is the primary state agency designated to regulate landfills. Division staff review applications for and issue/deny landfill permits. This consists of a review of the design and operational standards proposed, a past performance review of the applicant, and the relationship of the proposed facility to the local solid waste management plan. The Division also inspects landfills to monitor compliance with solid waste management regulations. Construction permits for landfills may be issued for up to 5 years. Initial operating permits are normally issued for 5 years upon completion of construction.

LANDFILL OPERATOR

The landfill operator is the person responsible for the daily operation of the landfill including: cover, compaction, monitor incoming wastes, safety, etc. The operator should be able to identify problems as they arise and report them to the landfill manager. Operation of a landfill is discussed in detail in the Operating Your Landfill Section of this manual.

CITIZENS

Citizens are clients of the landfill and can be the most vocal critics of its operation. A properly operated landfill will cause fewer complaints from citizens who live nearby. A strong citizen education program will promote a better understanding of the usefulness of a landfill and alleviate many fears associated with its operation.

OPERATOR CERTIFICATION PROGRAM

Each construction/demolition/debris landfill and contained landfill must have at least one certified landfill operator and one certified landfill manager or one individual certified for both categories. The Division may require a certified operator and/or manager at permit-by-rule, registered permit-by-rule, or residual landfill facilities as a permit condition. This requirement will be based on the characteristics of the waste stream, the site, and the experience and qualifications of the operator and/or manager.

The certified landfill operator must be physically at the facility during working hours. However, in the event the certified landfill operator cannot be at the site, the certified landfill manager or an interim operator, physically located on site, can be designated responsible for daily site operations. This provision is intended to ensure that only qualified personnel supervise landfill operations.

INTERIM OPERATOR

A new section was created to designate of an interim operator. An interim operator must be appointed whenever a certified landfill operator or manager has to be absent for an extended period. An "extended absence" means:

- more than 10 consecutive operating days for landfill operators
- more than 30 consecutive operating days for landfill managers
- more than 5 consecutive operating days for landfarming operators.

The permit holder must select the interim operator and notify the Division, in writing, 10 days prior to an anticipated absence and immediately upon discovery of an extended absence due to an emergency or unanticipated circumstance. The following information must be included in the notice:

- name and qualifications of intended replacement operator (must complete an application for operator certification (DEP 6031) to obtain this information), and
- length of replacement period.

The Division will:

- evaluate the qualifications, and
- notify the permit holder and intended interim operator, in writing, of approval or denial.

APPLICATIONS FOR CERTIFICATION

The individual seeking certification must file an application with the Division of Waste Management. The Division will review applications and supporting documents to determine the eligibility of the applicant. No one can be eligible for certification unless they complete the appropriate training class provided by the Division.

APPLICANT QUALIFICATIONS

Applicants will be evaluated on education and experience as it relates to the appropriate category of landfill. A landfill operator must have:

- completed high school, either by graduation or by obtaining an equivalency certificate, and
- one year experience.

If neither condition is met, the Division will consider the number of years experience in a related field in determining eligibility for examination on a year for year basis.

TRAINING CLASSES AND EXAMINATIONS

The Division will provide at least one scheduled training session each year. Certification will be granted at the end of the session if the applicant achieves a score of at least 70 percent on the examination. If requested, the examination can be given orally. If an individual fails the examination, the candidate for certification will be given the opportunity to re-take the examination once more without any additional charge. If the class participant fails the examination the second time, they will be required to wait until the next scheduled session to repeat the training class and examination.

ISSUANCE OF CERTIFICATES

Upon successful completion of the training session, the Division will issue both a full and wallet size certificate indicating the category of certification acquired. All landfill operators and managers are required to be recertified every 5 years.

If the certified operator terminates employment at a landfill, the certificate will remain valid until expiration or revocation. Certificates must be carried during working hours or displayed onsite. An individual who is not certified and assumes the responsibility of operator or manager must meet interim operator requirements and attend the next scheduled training session.

RELATIONSHIP OF CERTIFICATION TO LANDFILL PERMIT

With the exception of special waste landfills, every landfill in the state is required to have and be operated by a certified landfill operator and manager. A certificate may be revoked when the Division determines:

- the certificate was obtained by fraud, deception, or submission of inaccurate data,
- the certificate holder failed to perform required duties, including failure to comply with permit conditions, or
- the certificate holder failed to use reasonable care and judgment in performance of required duties.

Maintaining a certified operator and manager at a landfill is considered a condition of the landfill operating permit. The permit may be revoked and/or penalties sought for violation of this requirement.

STUDY GUIDE
WASTE MANAGEMENT IN KENTUCKY

1. Each person in Kentucky produces approximately ____ to ____ pounds of waste per day.

2. In Kentucky, wastes are classified as either _________________ waste or _________________ waste.

3. Solid waste includes ________________, _______________, ____________, or _____________ _____________ ____________

4. Hazardous waste is material that may present a hazard to _______________ ______________ or the ____________________ when improperly disposed.

5. Each year in Kentucky over ______ thousand tons of waste may be disposed of illegally.

6. Open dumps are breeding grounds for disease vectors such as ____________, __________, ___________, ____________ and _________. Twenty-two (22) ___________ diseases have been traced to improper solid waste management.

7. Other negative results of improper solid waste management include:

____

____

8. Proper Solid Waste Management practices include:

____

____

____

____

9. KRS 224.40-315 requires counties to develop and implement solid waste plans that must be updated every ______ years.

10. Each solid waste plan must address the following components:

____

____

____

____

11. Source reduction is normally practiced at the corporate level to ____________ waste from having to be managed at all.

12. Benefits of source reduction include:

____

____

____

____

13. The waste diversion goal in Kentucky is _________ percent.

14. Recycling is the separation of a given waste material. These may include: _____________, _____________, _____________, and _____________.

15. One of the major goals in development of a solid waste management plan is to increase ______________ _______________.

16. Types of door-to-door collection systems include:

____

____

____

____

17. _______________ _________________ is defined as "a municipal solid waste collection system that is established by ordinance, approved by the Cabinet and requires access for each household or solid waste generator in a county."

18. Three methods for the disposal of municipal solid waste are: ____________________, ____________________, ____________________.

19. Siting of new landfills is difficult in Kentucky due to:

____

____

20. Kentucky currently depends _____ percent on land disposal of its solid waste.

21. _______________ ________________ activities are essential to effective solid waste management.

22. Sites failing to meet environmental performance standards are called ______________ ___________.

23. Examples of Environmental Performance Standards include:

____

____

____

24. Landfill operation standards require: _____________ ________________ control while prohibiting ________________ ______________________.

25. Three major landfill categories that require a permit are:

____

____

____

26. __________________ and __________________ are no longer recognized as landfill permit categories.

27. In addition to landfills, the Division also issues permits for:

____

____

____

28. The ____________________ is the person who applies with the state agency for a solid waste site or facility permit.

29. The ___________________ should be consulted during all phases (construction, operation, and closure) of the site.

30. Solid waste permit applications must be consistent with __________________ regulations and zoning ordinances.

31. The landfill operator is responsible for:

____

____

____

32. The landfill manager is responsible for:

____

____

____

33. An interim operator would be hired if the regular landfill operator were going to be off _____________ consecutive operating days.

34. _______________________ and _________________ landfills must have at least one (1) certified operator and one (1) certified manager.

35. The certified operator must be _____________ at the facility during working hours.

36. You must score at least _______ percent on the operator’s test to obtain certification.

37. Your certificate may be revoked if:

____

____

____

CHAPTER 2
LANDFILL PERMITTING
GUIDELINES and PROCESS

The following section will guide you through major steps in the permitting process. However, it does not cover all the steps involved in obtaining a permit. To ensure all necessary information is included in the application you will need a set of statues and regulations. You can obtain a set by contacting the Program Planning and Administration Branch of the Division. A copy of the Regulation Order Form has been included in the Appendix Section of this manual. Landfill permitting laws are found in Kentucky Revised Statutes (KRS) Chapter 224. 401 Kentucky Administrative Regulations (KAR) Chapters 30, 40, 45, 47, 48 and 49 contain specific regulations for each type of solid waste disposal facility.

One of the most commonly asked questions the Division receives is "I have this piece of land and I was thinking about putting a landfill on it. What do I have to do to get a landfill permit?" Well, to answer that question one has to consider which of the following landfills you want to construct.

LANDFILL PERMIT CATEGORIES

A **contained landfill** will cost in the neighborhood of $750,000 to $1.2 million for the application. This includes the design engineer's cost (rock borings, soil borings, etc.) and permitting fees. Permit application fees for contained landfills currently run: $500 NOI, $10,000 Administrative, $5,000 Technical and $800 Construction Phase. A contained landfill will cost in the neighborhood of $150,000 to $250,000 per acre to construct the liner system and final cap. This does not include operating costs. Most contained landfill owners charge disposal fees ranging from $25 to $30 per ton to recover costs and make a profit.

A **greater than one acre construction/demolition/debris (C/D/D) landfill** will cost approximately $500,000 to $1 million for the application, this includes the design engineer's cost and permit application fees. Permit application fees for C/D/D landfills currently run: $500 NOI, $5,000 Administrative, $5,000 Technical and $500 Construction Phase. It costs approximately $75,000 per acre to construct a C/D/D landfill liner system and final cap. This does not include operating costs. Most C/D/D landfill owners often charge disposal fees ranging from $15 to $20 per ton.

Another category of landfill is a **residual landfill**. This landfill design is based on the type of waste to be put in the landfill. This liner and cap system can range from simply clearing the ground of vegetation, placing the waste and covering it up with dirt to as complex as a double composite liner system. The wide range of costs associated with this type of landfill is dependent on the waste that will be placed in it. Permit application fees for residual landfills currently run: $500 NOI, $2,500 Administrative, $2,500 Technical and $500 Construction Phase. Consultant fees range from $250,000 to $750,000. Residual landfill owners often charge disposal fees ranging from $10 to $15 per ton.

The last major landfill category is a **special waste landfill**. This landfill is commonly used for the disposal of utility waste (fly ash, bottom ash and scrubber sludge). This is a single phase application. Requirements for construction of this type of landfill are similar to residual landfill requirements. The fee to process the permit application is $5,000. Consultant fees range from $250,000 to $500,000. Special waste landfill owners often charge disposal fees ranging from $5 to $15 per ton.

THE PERMITTING PROCESS

This section details the history of solid waste management regulations. It also explains the permit application process for contained, construction/ demolition/debris, residual and special waste landfills. Also outlines public notice requirements and general conditions applicable to all solid waste sites or facilities.

The Division of Waste Management's developed the solid waste regulations to protect Kentucky's valuable groundwater and surface water resources.

THE APPLICATION PROCESS

Applications for new landfills consist of three phases - the Notice of Intent (NOI), the Administrative Application and the Technical Application. Kentucky Revised Statue (KRS) 224.40-310 and 401 KAR 47:140 Section 12 and 7(1)(a) through (d) describe the opportunities for public participation in the permitting process through oral and written comments and public hearing(s).

Financial assurance must be posted for closure and closure care. Bonding requirements are set forth in KRS 224.40-650 and 401 KAR 48:310 for solid waste facilities and 401 KAR 45:080 for special waste landfills. You will find a copy of all acceptable financial assurance documents in the Appendix of this manual.

The next thing you need to consider is the time it takes to get a construction permit, which allows you to build the landfill of your choice. Most landfill applications average eighteen to 36 months (including the time to correct any deficiencies with the application as well as hold public hearings that may be requested). It is important to remember that each site is unique. Unforeseen problems may occur that could possibly double the above estimates (a formal hearing adds 12 months).

STEP ONE - LOCAL DETERMINATION

Before you may submit your permit application to the Division of Waste Management for review, you must submit your proposal to the Local Solid Waste governing body of the county in which the site is proposed. This determination ensures that the proposed facility is consistent with the county and/or area plan. The governing body has sixty calendar days from receipt of the written request to make the determination. The requirements for this determination can be found in KRS 224.40-315.

At this point, it is strongly suggested that you schedule a meeting with the Division of Waste Management to discuss the location of the site as well as discuss various other permits necessary for this project, such as KPDES discharge permits, floodplain permit, transportation permit, etc. The Division has a list of agencies and people to contact for these other permits. Division staff is also available to discuss the permitting and public notification process.

STEP TWO - SUBMITTING THE NOTICE OF INTENT APPLICATION

Once you have your local determination (this determination can be either positive or negative) in hand, place the determination with the Notice of Intent Application and submit it to the Division.

> **NOTE:** <u>If the local determination is negative the Division will, in all likelihood, deny the application during this phase.</u>

Requirements for the NOI application can be found in 401 KAR 47:170. Generally, information required for the NOI application is simply a review of published information, such as general groundwater data, a soil boring and rock coring plan, threatened and endangered species data, historic places, archeological sites, etc. Once the Division accepts the application, the applicant is required to publish a notice in the local newspaper with the largest circulation in the area in which the landfill will be located. One of the most common errors found during completeness review of an application, is that an individual with signature authority for the company does not submit it. 401 KAR 47:160 section 6 describes who may submit an application. The Division has thirty working days to review the application after it is accepted. If there are deficiencies with the application, you will be notified by letter listing all of the deficiencies. Once the deficiency letter is dated and signed, the review clock is stopped until the application is resubmitted with the deficiencies corrected. The review clock is re-started at the point it was stopped (the clock does not restart at thirty working days). An important section of the application is to consider all the variances and/or alternate designs that may be necessary for your project. Siting requirements in 401 KAR 48:050 need to be closely evaluated for all new landfills.

STEP THREE - THE ADMINISTRATIVE APPLICATION

The administrative application is the second phase of the permitting process. This phase contains site specific information for developing the technical design of the landfill. The application will contain information concerning groundwater flow direction, estimates on the amount of soil that is available to construct and operate the landfill, types and sources of waste to be placed in the landfill, and a conceptual design of the landfill cap and liner design. The requirements of the administrative application are found in 401 KAR 47:180. The Division has sixty working days to review the application. As with the first phase, a letter will be sent if any deficiencies are found during the review process and the clock is stopped and restarted accordingly.

Once the Division approves the administrative application, you will be asked to supply two executive summaries. One will be sent to the County Judge Executive, the other is sent to the public library in the county where the landfill will be located when the notice for the administrative application is published.

This public notice will have a thirty day comment period to allow any interested parties an opportunity to comment on the proposed landfill. This comment period will not hold up the review of the technical application once it is received. If requested, a public hearing (as described in 401 KAR 47:140 sections 7 and 12) will be held in the county where the landfill is proposed. This public hearing is better described as a meeting to exchange information concerning the proposed landfill.

If a hearing is held, a court reporter will be present to record the meeting. Copies of the transcript will be available upon request. The only charge for the copy would be the cost to the Division to reproduce it.

STEP FOUR - THE TECHNICAL APPLICATION

The technical application is the last phase of the permitting process. It contains the design of the landfill cap, liner, and groundwater monitoring plan with any associated support facilities such as ponds, roads, maintenance buildings, etc. 401 KAR 47:190 contains all the requirements for the technical application.

A public notice is required to be published once the Division receives the technical application. This notice states that the technical application has been received by the Division for review. If you have the technical application prepared and ready for submittal at the end of the administrative application, this public notice can be combined with the administrative application public notice. In other words, the notice for the administrative application would read something like this "The administrative application is complete and the technical application has been received for review".

The Division has ninety (90) working days for the review of the technical application. As with the first phase, a letter will be sent if any deficiencies are found during the review process and the tolled periods are the same as in the first phase. When all the deficiencies have been corrected and each phase of the permit application has met all the applicable regulations, the Division will issue a draft construction permit. A final public notice is then published with a thirty day (30) comment period. This notice includes an opportunity to request an adjudicatory (formal) hearing.

It usually takes the Division two weeks to issue the draft permit. During this time, the Division is working out (with the applicant) the conditions of the permit and gathering the administrative record that will be housed in the public library for the duration of the comment period.

Once the comment period expires and no comments or requests for a hearing have been received, the construction permit can be issued. It usually takes the Division two weeks to issue the permit. During this time, each phase of the application is being stamped approved and signed to go along with the permit authorizing construction of the landfill. You will need these plans to construct the landfill correctly.

<u>Hearings requested during the technical comment period:</u> If a hearing is requested during this period it is an adjudicatory hearing. This is an adversarial proceeding in which everyone has a lawyer. This proceeding will add eight to twelve months to the permitting process. The Division cannot issue the construction permit until the issue(s) are resolved.

CONSTRUCTION

So, it is time to build your landfill. The Division will periodically send representatives to the site to verify that construction of the landfill is the same as what is in the approved design.

It is built! Now what? Once the Division receives certification from your consulting engineer that the landfill has been built according to the approved design, the Division has ten days to issue the operating permit provided the financial assurance documents (closure and closure care bonds) are in order and have been accepted by the Division.

TRANSITION PERIOD

If a residential or inert facility elected to close they did so by complying with the requirements specified below (401 KAR 47:080 section 4(4)):

- NOI was filed with the Division by November 8, 1990,
- operator maintains a valid operating permit, including bond, prior to and during closure,
- groundwater monitoring data includes the parameters identified in 401 KAR 48:300 section 11, for the respective facility category,
- operator performs corrective action provided for if required under 401 KAR 48:300, and
- a complete closure plan is filed which addresses the requirements of 401 KAR 47:080 section 5.

Residual landfills are designed and operated for disposal of specific types of waste. In view of this, specific closure designs are not identified in the regulations. The closure design proposed for a residual landfill must assure compliance with the Environmental Performance Standards in 401 KAR 47:030 and address:

- type and amount of waste in the facility,
- mobility and expected migration rates of the waste,
- site location, topography, surrounding land use, and final site use,
- climate of area,
- characteristics of cover material,
- geologic and soil profiles,
- surface and subsurface hydrology,
- corrective action work specified by the Division,

- deed for the property must be altered to include a statement that future disturbance of the site should occur only after checking for gas or leachate migration, and
- maintenance of the site for 2 years following closure in a manner that complies with the Environmental Performance Standards and the plan approved by the Division.

As previously discussed, facilities which elected to remain open past July 1, 1992, had to file by May 8, 1991 a permit modification to outline the type of facility they wished to convert to. In the case of residential landfills, a modification to meet the transition requirements to operate as a garbage landfill July 1, 1995 or convert to >1 acre C/D/D had to be filed. The category of facility selected - contained, construction/demolition/debris, or residual landfill - determines the type of design and operational standards. Identified below are regulations, which outline requirements for each category of facility. The details of each will be discussed in subsequent chapters of the manual.

GENERAL REQUIREMENTS FOR ALL LANDFILL TYPES

- 401 KAR 47:100 General Provisions for Obtaining a Solid Waste Permit
- 401 KAR 47:120 Conditions Applicable to all Solid Waste Permits
- 401 KAR 47:130 Changes to Solid Waste Permits; Expiration of Solid Waste Permits
- 401 KAR 47:160 Application Procedures
- 401 KAR 47:170 Notice of Intent to Apply for a Solid Waste Permit
- 401 KAR 47:180 Contents of the Administrative Application for Solid Waste Landfills
- 401 KAR 47:190 Contents of the Technical Application for Solid Waste Landfills
- 401 KAR 48:050 Siting Requirements for Solid Waste Landfills
- 401 KAR 48:300 Surface and Groundwater Monitoring and Corrective Action
- 401 KAR 48:310 Financial Requirements and Bonds

RESIDUAL LANDFILLS

- 401 KAR 48:170 Technical Requirements for Residual Landfills

>1 ACRE CONSTRUCITON/DEMOLITION/DEBRIS LANDFILLS

- 401 KAR 48:060 Technical Requirements for Construction/Demolition/Debris Landfills

CONTAINED LANDFILLS

- 401 KAR 48:070 Design Requirements for Contained Landfills
- 401 KAR 48:080 Liner and Cap Design Requirements for Contained Landfills
- 401 KAR 48:090 Operating Requirements for Contained Landfills

By July 1, 1992 all solid waste site facilities were required to:

- possess a permit which complies with the standards outlined in 401 KAR chapters 47 and 48 for the specific facility,
- have complied with the requirements specified to allow MSW disposal until July 1, 1995,
- cease to take waste, or
- have an application pending with the Division for one of these options.

PERMITTING AND PUBLIC INFORMATION PROCESS

State law requires that a permit be obtained to establish, construct, operate, or maintain a waste management site or facility. Solid waste regulations provide for a 3 phase application process for solid waste landfills. It also specifies time frames by which the Division must review and take action on each phase. Differing public information requirements also exist for the application phases. The only persons not required to obtain a permit for the disposal of solid waste are:

- return of agricultural wastes to the soils as conditioners,
- disposers of mining overburden, coal mining wastes, refuse, and coal mining by-products returned to the mine on the site of generation,
- owners of injection wells which have an Underground Injection Control Permit,
- users of septic tanks,
- owners of surface impoundments with Kentucky Pollutant Discharge Elimination Permits, and
- persons managing solid wastes during response to a spill of solid waste, imminent and substantial threat of a spill, or spill of material which, when spilled, becomes a solid waste.

The permit application process to construct or significantly expand a solid waste landfill permit consists of 3 phases:

- notice of intent to apply for a solid waste permit,
- administrative application, and
- technical application

LOCAL DETERMINATION

According to KRS 224.40-315, counties which host a landfill have an opportunity to make a determination on permit applications that request any additional volume before the Division of Waste Management accepts an application for review.

Local determination means that a local governing body (as designated in the county's solid waste management plan) reviews a permit application to determine if it is consistent with the county's solid waste management plan. With few exceptions, local determination applies only to the construction or any expansion of a municipal solid waste landfill.

The local governing body has 60 days to take appropriate action from the day it receives the written request from the applicant. The governing body must publish a public notice that a local determination has been requested in order to allow for public comment and/or a public hearing. After the public comment period, the governing body submits a written determination, to the Division on whether the permit application is consistent with the local solid waste management plan. To summarize, these are the steps necessary for local determination:

- Upon receipt of a written request for a local determination, the local governing body must public notice in a newspaper that a local determination has been requested. The public must be allowed input and opportunity for a public hearing. While there is not specific time period set by statue, a "reasonable" amount of time must be allowed for public input.
- Within 60 days (including the public comment period) the local governing body must submit a written determination to the Division. This determination should be based upon the data contained in the solid waste plan and should be specific.
- If the Division approves the permit application after the governing body has determined the application to be inconsistent, the Division will

provide written explanation to the governing body stating the specific reasons why it did not accept the local determination.

NOTICE OF INTENT

Filing a notice of intent with the Division is the initial step in the permitting process and is meant to:

- advise the division of the applicant's intent: permit a new facility or expand an existing site,
- identify the location of the site,
- allow for a general site review, relative to site suitability, based on existing data (i.e., Wild and Scenic Rivers Act, National Historic Preservation Act, etc.), and/or
- allow for a review and approval of plans to conduct field investigations to collect site specific information.

Specific requirements for the notice of intent are found in 401 KAR 47:170. Upon submittal of this application, the Division has 30 working days to complete its review. The 30 working day time frame does not include any time period the Division allows the applicant to make necessary modifications.

All applicants are required to public notice the submittal of a notice of intent. The public notice identifies the name and address of the applicant, gives a brief description of the facility to be permitted, details the location of the site including primary access routes, and the Division of Waste Management's name and address. The notice of intent application form contains a public notice form that the applicant must complete. The Solid Waste Branch will draft the public notice and forward it to the applicant for submittal of publication in a local newspaper. Evidence of publication must be submitted to the Solid Waste Branch thereafter.

ADMINISTRATIVE APPLICATION

Primary objectives of the administrative application are to allow the Division to review potential effects the site could have on human health and environment. The Division must complete its review of this application within 60 working days. 401 KAR 47:180 outlines all information required to be included in an administrative application, which includes:

- ownership information,
- disclosure of background information,
- potential impact on specific facilities, lands, resources, properties, and threatened or endangered species to include:
  a. geologic and hydrogeologic information,
  b. results of the geo-technical site investigation,
  c. topographic map showing buffer zones and waste boundary,
  d. report describing the proposed siting design and operating requirement restrictions, and
  e. soils information
- executive summary of the application.

Once the administrative application has been deemed administratively complete and the technical application has been received, the Division:

- issues a special notice, in the form of an executive summary, summarizing the content of the application to the county judge executive in the county in which the site or facility will be located, and
- requires the applicant to provide a public notice which provides a statement that an executive summary is available from the judge executive's office and allows for comments to be submitted or a public hearing requested.

The same procedures for publication of the public notice for the notice of intent apply to this phase of the application.

Whenever a public hearing is requested, a presiding officer is appointed to schedule and conduct the hearing. During this hearing, any person may submit oral or written statements and data. When a hearing of this type is held, the public comment period is automatically extended to the close of the administrative hearing or a later date specified at the hearing.

TECHNICAL APPLICATION

The third and final phase of the application process is the technical application. The purpose of this application is to outline specific technical standards for the facility design. The Division must complete its review of this application within 90 working days. The contents of this application will vary from site to site. Basic requirements are outlined in 47:190, but this information must be supplemented by technical requirements for the specific type of landfill proposed. This information may be found in 401 KAR 48:060 for construction/demolition/debris landfills, 48:170 for residual landfills, and 48:070 for contained landfills. Basic requirements outlined in 47:190 include:

- engineering plans showing the design and liner requirements of the site,
- narrative describing the design, construction quality control plan, and recordkeeping and reporting systems,
- closure and closure care plans, along with a cost estimate,
- design specifications for the final cap, and
- surface and groundwater monitoring plans.

The Waste Stream and Handling will discuss this information in detail.

Prior to making a decision to issue the permit, a written determination is made by the Cabinet that the application conforms to and is consistent with the area and state solid waste management plan. The applicant is required to issue a public notice for this phase of the application process.

Once the application is deemed technically complete, the Division will make a preliminary decision to issue the new or expanded permit or deny the application. The final decision is public noticed and receipt of comments allowed for a 30 day period. The public notice advertising the Division's preliminary determination must contain a statement that any person aggrieved by the action may file with the Cabinet a petition which outlines the grounds of the objection and demands a hearing pursuant to KRS 224.10-420. After the close of the public comment period and applicable hearings, the Division or the Secretary of the Cabinet may issue a final permit decision if a hearing is held. Once again the procedures for publication of the public notice for the first two phases apply to this phase of the application.

The permit review process, from the date of receipt of the notice of intent, to the date the Cabinet issue a draft permit to construct a solid waste landfill or denies the application, shall not exceed 365 calendar days, unless the Cabinet and applicant agree otherwise. However, the 30-60-90 working day clock takes precedence.

An applicant, who is issued a permit to construct or expand a solid waste landfill, will be issued a permit to operate in the areas included under the construction permit if the following conditions are met:

- a certification is submitted by the applicant from a registered engineer that the liner system and facilities are constructed in accordance with approved plans, and
- an engineer for the Cabinet has inspected the facility and the required financial assurance mechanism for closure has been submitted.

PERMIT MODIFICATION

Once a permit has been issued, the owner must comply with the following conditions, as specified by 401 KAR 47:120, whether or not they are identified within the permit. The owner of operator must:

- comply with all conditions of the permit. Failure to do so is grounds for enforcement action,
- apply for and obtain a new permit to continue operating after the expiration date of the permit and comply with 401 KAR chapters 47 and 48 prior to operating the facility,
- in the event of noncompliance, steps must be taken to minimize releases and adverse impacts on human health and environment,
- properly operate and maintain all facilities,
- furnish information requested by the Cabinet to determine whether cause exists to modify, revoke, or terminate a permit or to determine compliance,
- allow the Cabinet or its authorized representative to enter the facility, have access to and copy records, inspect equipment, and sample and monitor to ascertain compliance,
- properly sign all applications, reports, and information submitted to the Division,
- not operate new or modified facilities until a statement is received by the engineer that the facility has been constructed or modified according to the permit; and the Cabinet has inspected the facility, and issued the permit, and
- submit monitoring reports at the specified permit or regulatory intervals and submit compliance or noncompliance reports no later than 14 days following each date in a specified compliance schedule.

In addition to the above, the owner should be aware that issuance of a permit by the Division does not convey property rights or exclusive privilege. Any permit may be revoked or modified by cause. The permit issued is not transferable to any person without prior approval of the Cabinet.

FINANCIAL ASSURANCE

When a permit application is filed with the Division to construct a solid waste landfill, the applicant is required to submit post closure and closure care plans and a cost estimate for having a third party complete the work.

The estimate provided for closing the facility should be calculated at the point in the active life when the extent and manner of its operation would make closure the most expensive. In addition, the cost estimate should be based on the following:

- design,
- site grading and drainage,
- hauling and placement of each element of the cap,
- final cap grading and drainage,
- re-vegetation of the cap, and
- quality control and construction certification.

This figure will be adjusted for inflation and other factors each year.

A second cost estimate will be provided, in current dollars, of the cost of hiring a third party to conduct each phase of the closure care monitoring and maintenance. This estimate can be calculated by multiplying the annual cost estimate for each phase of closure care by the number of years of closure care required. For contained landfills, the minimum estimate accepted for closure care will be $10,000 per year using 1990 as the baseline year. As with the closure estimate, the closure care cost estimate should be based on the most expensive costs and must be revised if changes result which increase the cost.

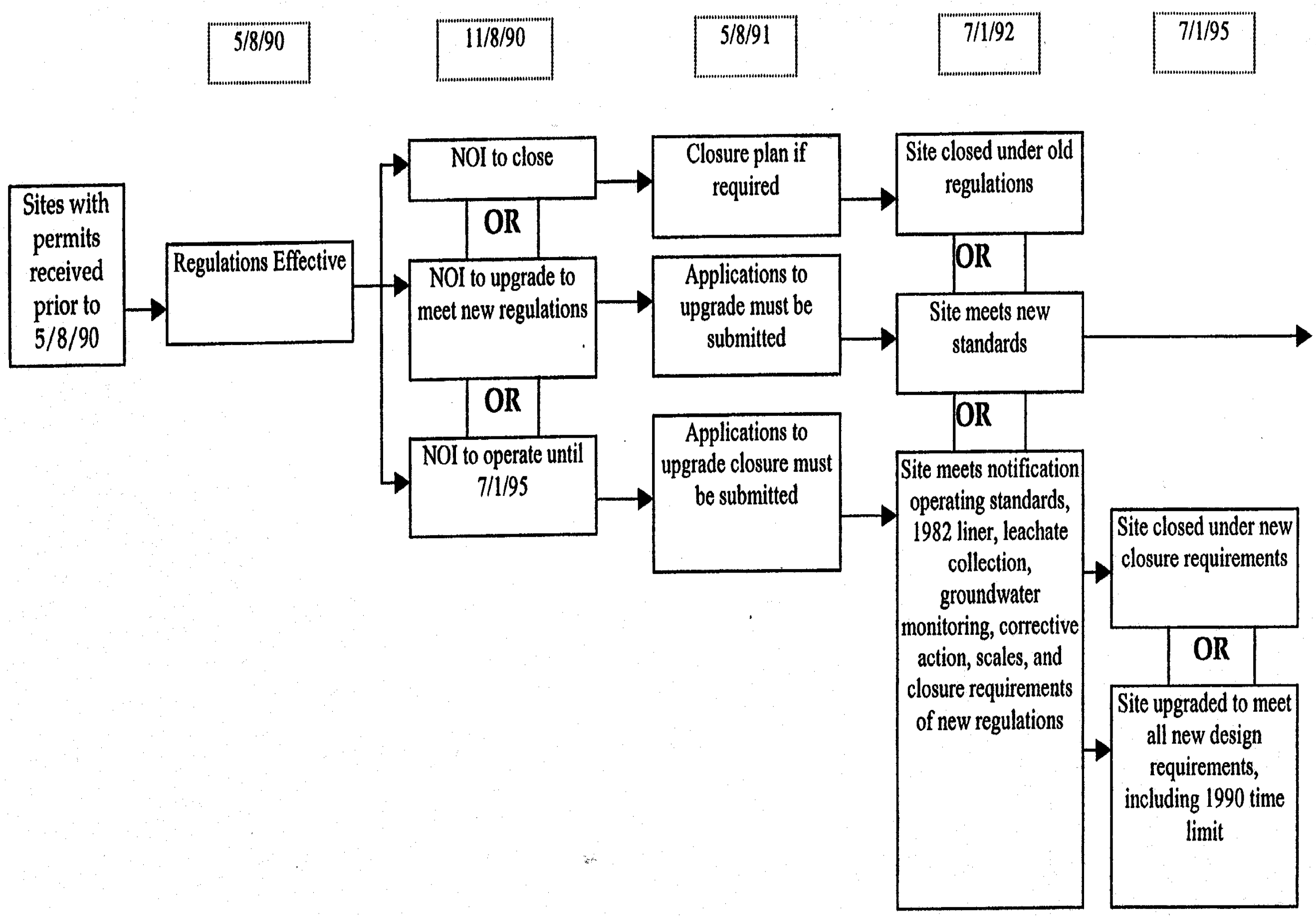
All applicants that obtain a permit for a solid waste site or facility must demonstrate that funds are available to them to meet the costs of closure and post closure care. For the private sector (except for waste sites which are located on property of the generator which accept industrial solid waste from the generator only), this assurance must be accomplished by posting a performance bond and one of the following:

- surety bond,
- letter of credit, or
- escrow agreement.
- trust fund
- closure insurance

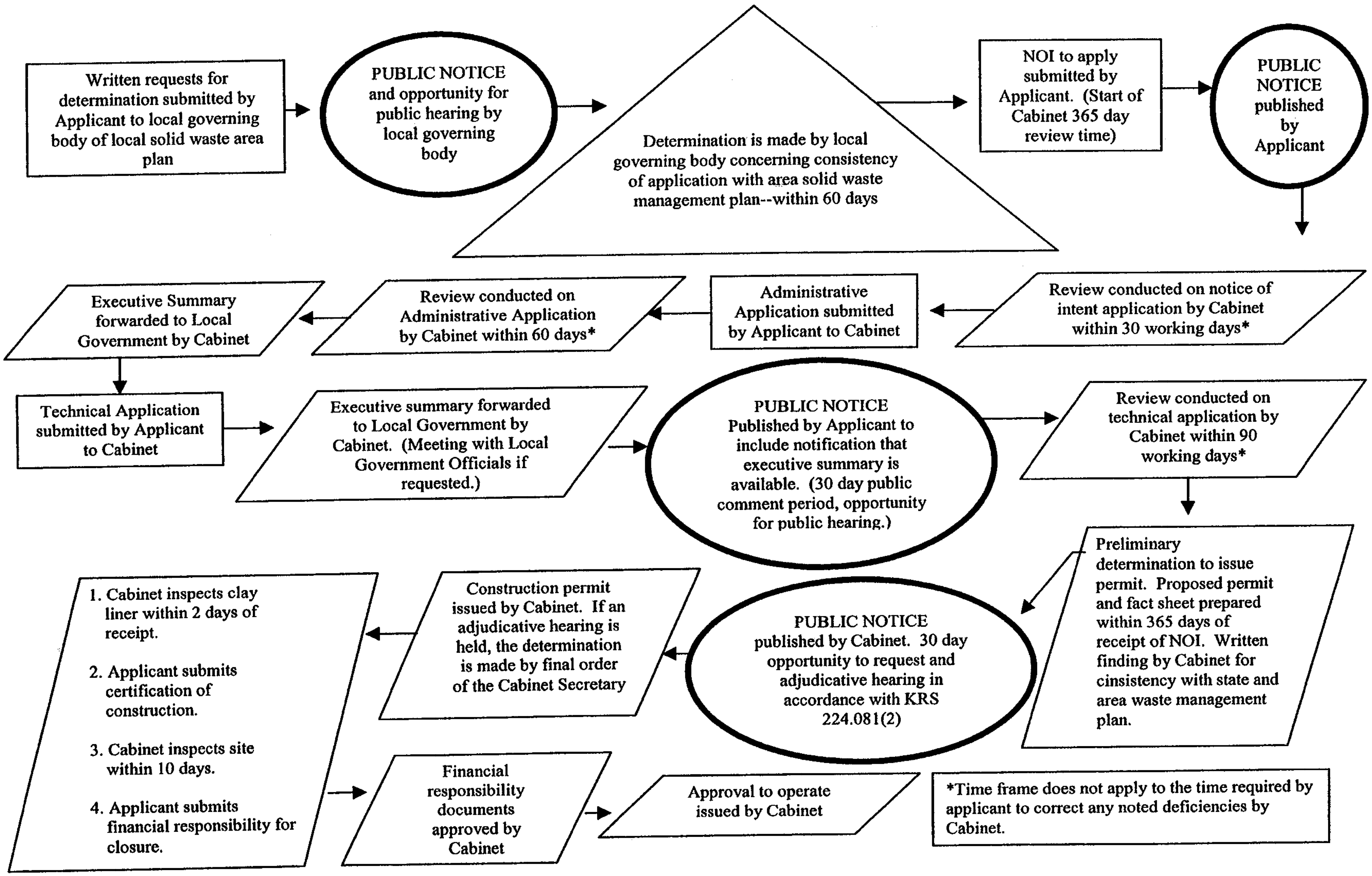
Information on each of these mechanisms may be found in 401 KAR 48:310 along with the wording required for the actual agreements.

Any owner which is a city, county, urban county government, 109 district, taxing district, political subdivision of the Commonwealth, the Commonwealth or any agency thereof, or any entity whose debts and liabilities are those of the above are considered to be a publicly owned facility. Publicly owned facilities are exempt from posting a performance bond by KRS 224.43-610. However, the facility must provide a budget for the permitting, construction, operation, closure, and post closure of the facility. This budget must be revised annually. When any of the elements identified above are to be accomplished by contract or agreement, a copy of these documents must be submitted to the Cabinet.

FIGURE 2-1
TIMING OF ACTIONS DURING THE TRANSITION PERIOD



LANDFILL APPLICATION PROCESS FOR NEW CONTAINED, RESIDUAL, C/D/D AND SUBSTANTIAL ADDITIONAL CAPACITY EXPANSIONS – FIGURE 2-2



STUDY GUIDE
LANDFILL PERMITTING GUIDELINES/
THE PERMITTING PROCESS

1. List four types of landfills you must obtain permits for:

   ____

   ____

   ____

   ____

2. Most landfill applications take __________ to ___________ months to go through the entire permitting process.

3. What are the five major phases an application must pass through before final approval is given for a landfill to legally accept waste?

   ____

   ____

   ____

   ____

   ____

4. Why is it important to obtain a Local Determination before submitting an application for a solid waste disposal facility to the Division?

   ____

   ____

   ____

5. The state shall __________ a landfill application for any expansion without a local determination.

6. Contained landfill facilities are subject to ____ year closure care requirements.

7. Permit applications to construct or modify a landfill consist of three phase:

____

____

____

____

8. List information contained in the Notice of Intent.

____

____

____

9. The Division of Waste Management's final determination on the issuance of a construction permit may not be made until

____

____

____

10. The cabinet will issue a permit to operate a solid waste landfill when:

____

____

____

11. A private landfill must post at least one of the following financial guarantees to ensure proper closure and closure care. This guarantee must be submitted along with the initial application.

____

____

____

CHAPTER 3
WASTE STREAMS AND HANDLING

Solid wastes are classified according to types and properties. This section describes wastes that are acceptable, unacceptable; require special handling, and/or special permission for disposal at different types of landfills. Solid waste is produced from various sources including households, businesses, and farms. Outlined below are examples of wastes produced from each of these sources.

TYPES OF WASTE

People dispose of many different types of waste. Not all landfills are permitted to accept all waste that can be generated by certain households, businesses and industries. Before we discuss which wastes are acceptable at certain landfills, it is important to understand the differences in waste streams. The following types of wastes are generated on a daily basis:

> **Solid wastes** (as defined by KRS 224.01-010): Any garbage, refuse, sludge, and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining (excluding coal mining wastes, coal mining by-products, refuse and overburden), agricultural operations, and from community activities, but does not include those materials including, but not limited to sand, soil, rock, gravel, or bridge debris extracted as part of a public road construction project funded wholly or in part with state funds, recovered material, special wastes as designated by KRS 224.50-760, solid or dissolved material in domestic sewage, manure, crops, crop residue, or a combination thereof which are placed on the soil for return to the soil as fertilizers or soil conditioners, or solid or dissolved material in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Federal Pollution Control Act, as defined by the Atomic Energy Act of 1954, as amended (68 stat. 923).

MUNICIPAL SOLID WASTE

RESIDENTIAL

Residential waste consists of both putrescible and non-putrescible waste generated by households. Household Solid Waste: Solid waste, including garbage and trash generated by single and multiple family residences, hotels, motels, bunkhouses, ranger stations, crew quarters, and recreational areas such as picnic areas, parks, and campgrounds. The average density of this waste is 500 to 1,000 lbs. per cubic yard as it enters the landfill. This type of waste must be disposed of at a contained landfill and will contain:

- food wastes, which are putrescible (decay or rots quickly). These wastes attract flies and rats and can cause odors,
- paper and packaging,
- hazardous waste such as paint thinners, drain cleaner, pesticides, etc., generated by households, (batteries must go to a recycler)
- bulky items (furniture appliances, white goods), and other bulky items that can be difficult to handle and compact.
- must be disposed of in contained landfills, and
- average density is 500 to 1000 lb./cubic yard as it enters the landfill,

COMMERCIAL

All types of solid waste generated by stores, offices, restaurants, warehouses, and other service and non-manufacturing activities, excluding household and industrial waste. Examples include: food, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, tin cans, aluminum, ashes, leaves, tires, white goods, furniture, household hazardous waste, etc. This waste is primarily disposed of at a contained landfill. It is difficult to get a good compaction rate for this waste and it is slow to decompose. The average density is 200 to 700 lbs. per cubic yard. This waste may contain:

- contains a large amount of paper and packing materials (i.e., paper, plastic, cans, etc.) and some wood which are combustible and have the potential to catch on fire,
- slow to decompose,
- difficult to get good compaction, and
- primarily disposed of at contained landfills but some non-putrescible wastes may go to construction/demolition/debris landfills
- average density is 200 to 700 lb./cubic yard,

INSTITUTIONAL

Institutional wastes are wastes generated by schools and hospitals. This waste must be disposed of in contained landfills. This waste contains:

- large amounts of both food wastes and paper/packaging wastes,
- regulated hazardous wastes such as laboratory chemicals,

- needles, bandages, body parts, bedding, etc., and
- infectious wastes, which are not classified as hazardous wastes.

Medical (Biohazard/Infectious) Waste: Wastes resulting from the operation of hospitals, and nursing homes, and may cause disease or reasonably be suspected of harboring pathogenic organisms. Examples include: diseased human parts, contaminated bandages, pathological specimens, hypodermic needles, contaminated clothing, surgical gloves, etc.

- Hospitals and nursing homes generate medical wastes such as needles, bandages, body parts, bedding, etc., and
- Infectious wastes not classified as hazardous wastes and may be disposed of in contained landfills.

CONSTRUCTION/DEMOLITION/DEBRIS

C/D/D Wastes: Solid waste which results from the construction, remodeling, repair, and demolition of structures and roads. This waste consists primarily of building materials and rubble, is relatively inert with the exception of wood and does not compact well (it ranges widely). Examples include: bricks, concrete and other masonry materials, wood, rock, uncontaminated soil, wall coverings, drywall, plumbing fixtures, metals, furniture, shingles, insulation, etc. Asbestos from these buildings may only be disposed of in a contained landfill

- consist of waste building materials and rubble,
- relatively inert with the exception of wood, and
- primarily disposed of in construction/demolition/debris landfills.

SPECIAL WASTE

Special wastes (as defined in KRS 224.50-760): Those wastes of high volume and low hazard. Examples include: mining wastes, utility wastes (fly ash, bottom ash, scrubber sludge), sludge from waste and wastewater treatment facilities, cement kiln dust, gas and oil drilling muds, oil production brines, etc. Any waste not listed in the law may only be considered special waste if the generator files and Cabinet approves a petition stating that the characteristics are present:

- Waste exhibits the characteristic of high volume as determined by:
    a. Non-liquid wastes that are generated at an average annual rate of greater than 49,614 tons or 45,000 metric tons per year per Kentucky facility.
    b. Liquid wastes that are generated at an average annual rate of more than 1,000,000 metric tons per year per Kentucky facility.
- Waste exhibits the characteristic of low hazard if:
    a. There is a low probability that the management, processing, or disposal of the waste would violate the provisions of 401 KAR 30:031.
    b. The waste is not a hazardous waste as defined in 401 KAR chapter 31.
    c. The waste is not mixed with, co-disposed or co-treated with solid waste or hazardous waste.

Sewage Treatment Plant Residues: The sewage treatment process generates sewage treatment plant residues. These residues:

- contain coarse screenings and de-watered sludge,
- require an additional waste stream approval from the landfill operator prior to disposal,
- may present a fire hazard in large accumulations.

NOTE: Septic tank pumpings cannot be accepted at solid waste landfills without the addition of bulking agents, which will ensure that they pass the paint filter test. This is due to the large amount of free liquids this waste contains.

WASTE TIRES

Waste tires generated by households, dealers, junkyards, and other businesses other than tire-manufacturing industries are considered both municipal solid wastes and waste tires under the law.

PETROLEUM CONTAMINATED SOIL

Petroleum contaminated soil is considered a municipal solid waste unless it is the by-product of a manufacturing process.

INDUSTRIAL/RESIDUAL SOLID WASTE

Solid waste generated by manufacturing or industrial processes that is not a hazardous waste or a special waste. Examples include: waste from fertilizer or agricultural chemical manufacturing, wastes from plastics and resin manufacturing, waste from the pulp and paper industry, water treatment sludge, waste from air pollution control devices, etc. This term does not include residential like wastes that come from offices, lunchrooms and packaging (unless packaging is what is being made at a particular facility). Industrial waste should be disposed of in a contained or residual landfill. Some examples of industrial wastes are:

- sludges (paint waste, water treatment),
- dusts (air pollution control),
- cuttings, grindings, stampings, product rejects, and
- contaminated soils if they result from an industrial process.
- large amounts of paper/packaging wastes, and
- may contain regulated small quantity hazardous wastes such as laboratory chemicals, if disposed in a contained landfill.

FARMING/AGRICULTURAL WASTES

Agricultural wastes are non-hazardous wastes generated from the production and processing of on the farm agricultural products. Similar wastes produced by racetracks, tree services, or other businesses are not considered agricultural waste.

MANURE AND CROP RESIDUES

Manure and crop residues are exempt from the definition of solid waste when returned to the soil as fertilizer or soil conditioners in practices common for this use.

HERBICIDES AND PESTICIDES

Herbicides and pesticides are not classified as agricultural wastes. Empty containers must be triple rinsed before they may be disposed of at a solid waste landfill. Furthermore:

- pesticides residues are not regulated hazardous wastes when disposed of in accordance with label instructions, and
- only a farmer disposing of pesticide residues from his own use is exempt.

HAZARDOUS WASTE

Hazardous Wastes (as defined in KRS 224.01-010): Any discarded material or material intended to be discarded or substance or combination of such substances intended to be discarded, in any form, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed or, or otherwise managed. Examples include: paint wastes, discarded chemicals, discarded pesticides, spent solvents, incinerator ash, electroplating wastes, etc. (see 401 KAR 31:030 and 401 KAR 31:040). Manufacturing facilities, small businesses, and institutions such as hospitals, schools and universities typically generate hazardous wastes. A waste is classified as a hazardous waste if it is listed or testing shows, it meets the characteristic of a hazardous waste. The regulations related to hazardous waste determinations can be found in 401 KAR chapter 31.

- Listed wastes include wastes generated by nonspecific industrial operations such as degreasing solvents, other spent solvents, electroplating operations, and specific sources such as petroleum refiners, wood preservers, etc.
- Discarded commercial products, off specification chemicals, container residues and spill cleanup residues may also be listed hazardous waste
- Some of the wastes described in the preceding paragraph are considered to be "acutely toxic" and become regulated when as little as one quart is generated
- Hazardous waste characteristics in general terms are as follows:

    a. Ignitable wastes are liquids with a flash point below 140°F
    b. Corrosive wastes are aqueous liquids with a pH below 2.0 and greater than 12.5
    c. Reactive wastes are unstable under normal conditions and can explode or react violently with water to explode or produce toxic gases.
    d. Toxic wastes can leach designated contaminants when subject to the toxicity characteristic leaching procedure (TCLP) test. This test is designed to simulate landfill conditions.

Limited Quantity Generators: Persons who generate less than 220 pounds of hazardous waste in any one-month are conditionally exempt small quantity generators. Hazardous wastes from this type of facility are exempt from hazardous waste regulations. Therefore, they are acceptable for disposal at some contained landfills. Small quantity (220 to 2,200 pounds) and large quantity (over 2,200 pounds) generators either must handle hazardous waste onsite or ship wastes to a permitted hazardous waste treatment, storage, disposal, or recycling facility.

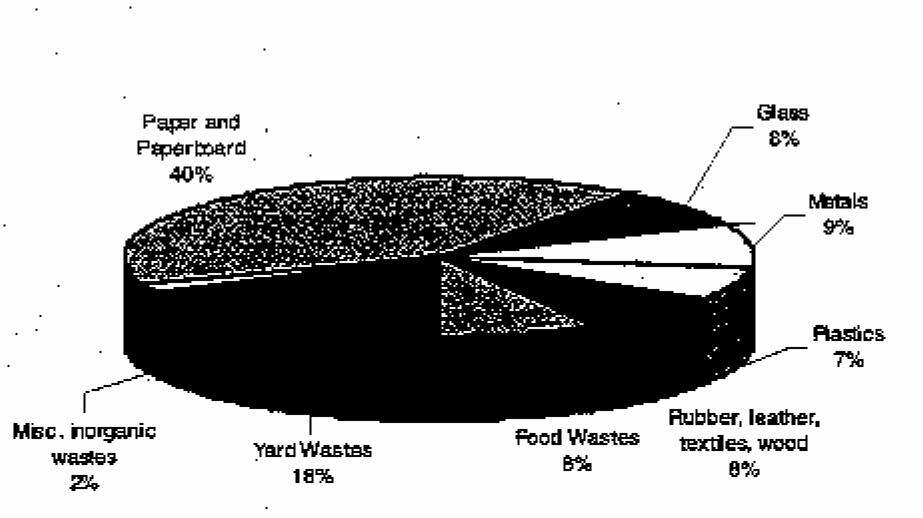
- Do not accept any waste accompanied by a hazardous waste manifest.
- Division of Waste Management field office must be notified immediately when actual or suspected hazardous waste is found during random inspections or during unloading.

Random inspections are an important method to detect these wastes and prevent their disposal at a solid waste landfill.

WASTE COMPOSITION

The composition of waste varies widely between household, commercial and industrial discards. For an average community in the United States, waste composition is 18.5 percent organic (glass, metal) and 81.5 percent organic (paper, plastics, rubber, leather, textiles, wood, food, and yard waste). The U.S. Environmental Protection Agency quotes these estimates.

FIGURE 3-1



Seasonal variations in waste composition affect the amount of waste generated. An example of a seasonal variation is yard wastes, which are a major component of residential waste in the summer months but practically non-existent in the winter.

Recycling can also have an important impact on the waste stream. As certain materials are recovered (such as newspaper, cardboard, and aluminum) the amount and composition of waste changes. Waste composition is also subject to change as one type of material displaces another and/or consumer buying habits change (e.g. plastic bottles or aluminum instead of glass).

WASTE STREAMS ACCEPTABLE FOR DISPOSAL AT SOLID WASTE LANDFILLS

The landfill-operating permit identifies the types and geographic source(s) (county/state of waste origination) of wastes a landfill is approved to receive. Once the permit is issued, any waste described from any geographical source, listed on the permit, may be accepted without further written approval.

HOUSEHOLD HAZARDOUS WASTE

Household hazardous wastes are leftover or unwanted commercial products used in the home. They have the same hazardous properties as regulated industrial hazardous wastes but are not regulated when generated by households. This means they can ignite or catch fire; react or explode when mixed with other substances; irritate or burn skin; or they are toxic and can adversely affect human health. Household hazardous wastes have the potential to pollute the air and water when disposed of in any landfill other than a contained landfill or flushed down the drain.

Examples include:

- paints,
- pesticides,
- herbicides,
- solvents, and
- caustics, etc.

WASTES REQUIRING SPECIFIC WRITTEN APPROVAL

For contained landfills, any non-residential like waste (waste that does not originate from a household) stream must be approved at the landfill before disposal. The waste must first be characterized and a TCLP or paint filter test conducted. Appendix A contains a copy of the Division's additional waste stream application form.

ASBESTOS

Asbestos wastes can be generated from manufacturing, fabricating, demolition, renovation and spraying operations. Any exposure to airborne asbestos particles for even a short amount of time increases the risk for an adverse health impact. The Division of Air Quality regulates the removal and handling of asbestos before disposal. Outlined below are the regulatory requirements relative to treatment and disposal of asbestos containing material (ACM).

- ACM must be wetted down, placed in two 6 mil. plastic bags and sealed in rigid containers before transporting to the landfill. Either fiber or metal drums are acceptable.
- When ACM wastes are not transported in sealed, rigid containers the transported must have a written waiver from the Division of Air Quality. Bags of ACM waste should not be accepted without a written waiver.
- Drums and bags must be marked with a caution label.
- Do not allow trucks containing ruptured bags to unload.
- Drums must be handled and disposed of in a manner that prevents breaking open containers during unloading and covering.
- The location and placement of ACM should be clearly identified in facility records. These records should document the X, Y and Z coordinates (horizontal, vertical and depth) of the ACM waste.

SLUDGES

Sludges are defined as solids, semi-solids or dusts generated by wastewater treatment units and air pollution control devices. In order to be disposed of in a landfill, sludge cannot contain any free liquids and be hazardous. It may be necessary to perform a TCLP and paint filter test to determine suitability for landfill disposal.

LIMITED QUANTITY GENERATOR HAZARDOUS WASTE

Persons who generate less than 220 pounds of hazardous waste per month are limited quantity generators. These wastes may be disposed of in contained landfills provided:

- the waste passes the paint filter test,
- limited quantity hazardous wastes are listed as a waste type in the permit,
- the facility generating the wastes is listed in the permit, and

- The location and placement of LQGHW should be clearly identified in facility records. These should document the X, Y, Z coordinates of the LQGHW wastes.

CONTAMINATED SOILS

During the clean up of spills and releases, contaminated soils and other debris may be generated. One of the most common sources of this waste is soil generated during the removal of underground storage tanks. The following guidelines should be adhered to when receiving these wastes:

- **do not accept any** contaminated soils unless you know the source of contamination and the soil has been analyzed (TCLP) to demonstrate it is not a regulated hazardous waste,
- PCB spills of oils containing less than 50 ppm PCB may be disposed of at a contained landfill,
- petroleum contaminated soils generated during the removal of underground storage tanks are not a hazardous waste; however, other gasoline contaminated soils must be tested for a hazardous waste determination, and
- petroleum contaminated soils may be used for daily cover if the maximum benzene concentration is equal to or less than 1.0 ppm and if the material is not placed during a precipitation event.

See appendix A for additional wastes that require a permit modification.

WASTES UNACCEPTABLE FOR DISPOSAL AT SOLID WASTE LANDFILLS

UNPERMITTED GEOGRAPHIC SOURCE

Any waste from a city, county or other geographic source not specifically listed in the permit cannot be accepted. An add/delete waste source application must be filed with and approval received from the Division before acceptance at a landfill.

HAZARDOUS WASTE

Manufacturing facilities, small businesses and institutions such as hospitals, schools and universities typically generate hazardous wastes. A waste is classified as a hazardous waste if it is listed or testing shows, it meets the characteristic of a hazardous waste and exceeds the small quantity limit of 2.2 or 220 lbs/mo.

Regulations related to hazardous waste determinations can be found in 401 KAR chapter 31.

- listed wastes include wasted generated by nonspecific industrial operations such as degreasing solvents, other spent solvents, electroplating operations, and specific sources such as petroleum refiners, wood preservers, etc.
- discarded commercial chemical products, off specification chemicals, container residues and spill cleanup residues may also be listed hazardous waste
- some of the wastes described in the preceding paragraph are considered to be "acutely toxic" and become regulated when as little as one quart is generated
- hazardous waste characteristics in general terms are as follows:

    1. ignitable wastes are liquids with a flash point below 140^{o}F.
    2. corrosive wastes are aqueous liquids with a pH below 2 and greater than 12.5
    3. reactive wastes are unstable under normal conditions and can explode or react violently with water to explode or produce toxic gases.
    4. toxic wastes can leach designated contaminants when subject to the toxicity characteristic leaching procedure (TCLP), a test designed to simulate landfill conditions.

Persons who generate more than 220 pounds of hazardous waste in any one-month are regulated hazardous waste generators. Small quantity (between 220 to 2200 pounds) and large quantity (over 2200 pounds) generators must handle hazardous waste onsite or ship wastes to a permitted hazardous treatment, storage, disposal or recycling facility.

Be aware of the following:

- do not accept any waste accompanied by a hazardous waste manifest,
- Division of Waste Management field office must be notified immediately when actual or suspected hazardous waste is found during random inspections or during unloading, and
- random inspections are an important method to detect these wastes and prevent their disposal at a solid waste landfill.

LIQUIDS/OILS

- Liquids and oils contribute to the generation of leachate and may contain hazardous constituents that are a threat to groundwater and surface water.
- Wastes must pass the paint filter test before they are disposed of in a landfill.
- Some liquids may contain vapors, which can easily ignite.
- Unused paint can be recycled by giving it away.
- Some liquids can irritate the skin or cause burns.

Recycle used oil by taking them to a registered location. Contact the Division for a list.

LEAD ACID BATTERIES

- Batteries contain a strong acid that could cause serious burns to the skin if operators came in contact with the liquid. They also contain high levels of lead, which can contaminate surface water or groundwater.
- Lead acid batteries become a hazardous waste when the case is broken.
- Lead acid batteries can be recycled and can only be accepted by a retail or wholesale seller of new lead acid batteries, a lead smelter, a recycler or collection facility delivering to a smelter or recycler.

WHOLE TIRES

Effective July 15, 1992, KRS 224.50-820 required tires to be processed to prevent the entrapment of air or water before disposal in a landfill. Large off the road tires, such as the tires like the ones used on construction and mining equipment, may be placed in the bottom of a landfill cell or mining pit whole if the criteria specified in the "Notice to All Contained Landfill Owners and Waste Tire Facility Registrants Disposal Of Large Off-the-Road (OTR) Tires" dated December 15, 1999 (enclosed in appendix section) is met.

WHAT WASTES CAN YOU TAKE IN YOUR LANDFILL?

The operating permit for a contained or C/D/D landfill identifies the types and geographic source(s) of wastes the landfill is approved to receive. Once the permit is issued, the appropriate waste from any geographic source may be accepted without further written approval.

CONTAINED LANDFILL - 401 KAR 47:080 Section 2(1) lists common acceptable waste streams for contained landfills. **Acceptable waste streams include the following:**

- All **non-hazardous solid wastes** including household, commercial, institutional, industrial, municipal and C/D/D waste.
- **Properly processed tires:** shredded, quartered, or equivalent.
- **Household hazardous wastes:** leftover or unwanted commercial products used in the home that have the same hazardous properties as regulated industrial hazardous wastes. This means they can ignite or catch fire; react or explode when mixed with other substances; irritate or bum skin; or, they are toxic and can adversely affect human health. The wastes:

  - ✓ can include paints, pesticides and herbicides, solvents, caustics, etc.,
  - ✓ are not regulated as hazardous waste when generated by households,
  - ✓ have the potential to pollute air and water when disposed improperly, and
  - ✓ may be disposed of in contained landfills or recycled.

- **Asbestos containing waste:** Asbestos-containing wastes can be generated from manufacturing, fabricating, demolition, renovation, and spraying operations. Any exposure to airborne asbestos particles for even a short amount of time increases the risk of adverse health affects. The Division regulates the removal and handling of asbestos, before disposal, for Air Quality. Outlined below are the regulatory requirements relative to the treatment and disposal of asbestos containing material (ACM).

  - ✓ must obtain specific written approval by the Cabinet to accept,
  - ✓ should accept early in the day so that ACM will be at the bottom of the lift or dig hole in waste and bury,
  - ✓ must be wetted down, placed in 2 (6 mil.) plastic bags and sealed in rigid containers before transporting to the landfill. Either fiber or metal drums are acceptable,
  - ✓ when ACM wastes are not transported in sealed rigid containers, the transporter must have a written waiver from the Division for Air Quality; bags of ACM waste should not be accepted without a written waiver,
  - ✓ drums and bags must be marked with a caution label,
  - ✓ do not allow trucks containing ruptured bags to unload, and drums must be handled and disposed of in a manner that prevents breaking open containers during unloading and covering

- **Sludges:** defined as solids, semi-solids or dusts generated by wastewater treatment units and air pollution control devices.

  ✓ must obtain specific written approval by the Cabinet to accept,
  ✓ testing is necessary to verify a sludge is not a hazardous waste (TCLP),
  ✓ must be dry or pass the paint filter test (method of testing for free liquids), and
  ✓ may be treated before disposal at the landfill to remove free liquids (belt press, drying beds, etc.).

Conditionally Exempt Small Quantity Generator Hazardous Waste: people who generate less than 220 pounds of hazardous waste per month are conditionally exempt small quantity hazardous waste generators. These wastes may be disposed of in contained landfills provided that the owner or operator:

✓ obtains specific approval by the Cabinet, and
✓ ensures that the waste passes the paint filter test.

- **Contaminated Soils:** During the clean up of spills and released, contaminated soil and other debris may be generated. One of the most common sources of this waste is soil generated during the removal of underground storage tanks.

  ✓ **Do not** accept any contaminated soils unless you know the source of contamination and the soil has been analyzed to demonstrate it is not a regulated hazardous waste.
  ✓ PCB spills of oils containing less than 50 ppm PCB may be disposed of at a contained landfill.
  ✓ Petroleum contaminated soils, generated during the removal of underground storage tanks, are not a hazardous waste; however, other gasoline-contaminated soils must be tested for hazardous waste determination.
  ✓ Contaminated soil can be used as daily cover only if benzene concentration is less than 1 ppm and material is not applied during a precipitation event.

- **Tire Chips used for liner and drainage layer protection.** Please see the "NOTICE TO ALL CONTAINED SOLID WASTE LANDFILLS-effective November 17, 2000, for all the specifics. You will find it in the Appendix Section of this manual.
- **Any other wastes listed as acceptable in the landfill permit**

CONSTRUCTION/DEMOLITION/DEBRIS (C/D/D) LANDFILL

401 KAR 47:080 section 2(2) lists common acceptable and unacceptable waste streams. Acceptable wastes include the following:

- Any solid waste, which results from the construction, remodeling, demolition or repair of structures and roads.
- Uncontaminated solid waste consisting of vegetation resulting from land clearing and grubbing, utility line maintenance, and seasonal storm related clean up. Such wastes include, but are not limited to:

  a. bricks, concrete and other masonry material
  b. shredded or segmented tires
  c. clean soil and rock
  d. wood
  e. wall coverings
  f. plaster and drywall
  g. plumbing fixtures
  h. tree stumps, limbs, leaves and yard waste
  i. sawdust
  j. paper and paper products
  k. metals
  l. furniture
  m. insulation
  n. roofing shingles
  o. asphaltic pavement
  p. glass
  q. plastics that are not sealed in a manner that conceals other waste
  r. electrical wiring
  s. components containing no liquids or hazardous metals that are incidental to any of the above materials
  t. any other inert waste as approved by the Cabinet

Unacceptable Waste:

a. waste from an unpermitted geographic source
b. waste not listed on the permit
c. waste that does not result from construction, demolition, remodeling or repair of structures or roads
d. electrical fixtures containing hazardous liquids such as fluorescent light ballasts or transformers

e. PCB containing waste
f. hazardous material spill residues
g. conditionally exempt small quantity generator waste
h. any hazardous waste regulated by 401 KAR chapters 31 and 32
i. whole tires
j. liquids
k. drums
l. fuel tanks

RESIDUAL LANDFILLS

There are no detailed acceptable waste streams for residual landfills listed in the regulations. A residual landfill can only dispose of the waste streams listed on their permit. A TCLP analysis of all waste streams is required before disposal. In general, the following waste streams are <u>not acceptable</u> at residual landfills:

- hazardous waste
- municipal solid waste
- free liquids

SPECIAL WASTE LANDFILLS

An owner or operator may dispose only special waste in a special waste landfill. These wastes include utility coal combustion ash, air or water treatment sludges, and certain oil field wastes. As with residual landfills, there are no detailed acceptable waste streams for special waste landfills listed in the regulations. As long as the waste stream is listed as acceptable on the permit, it can be disposed of in a special waste landfill.

In general, the following waste streams are **not acceptable** at special waste landfills:

- hazardous waste
- municipal solid waste
- industrial solid wastes

<u>SPECIAL HANDLING CONSIDERATIONS FOR SPECIFIC TYPES OF WASTE</u>

The following is an overview of how certain waste streams must be handled.

ASBESTOS

- Cover immediately with 2 to 4 feet of compacted garbage.
- When covering asbestos, a sufficient cushion of garbage must be maintained between the equipment and asbestos to prevent releases to the air.
- Landfill employees must comply with OSHA standards when handling asbestos wastes.
- Other landfill users should not be allowed in an area where asbestos is being handled.
- Must be transported in approved containers (a truck is not a container) and exceptions require written approval from the Division for Air Quality.
- Containers or bags must not be ruptured during handling and compaction.
- If required by the permit, asbestos must be buried in a separate area.

SLUDGES

- Must be placed in the working face and co-mixed with refuse unless an alternate method is specified in permit,
- cannot be used for daily cover, and
- can only be applied to cover soil to aid in re-vegetation if approved by permit.

BULKY ITEMS

- Can lend to uneven settlement which prevents adequate runoff,
- crushing, compacting or shredding on solid ground before pushing into the working face is recommended,
- place in bottom of cell or separate area,
- objects placed in the initial lift must not be allowed to damage the bottom liner (401 KAR 48:090 section 9),
- materials for salvage or recycling may only be accumulated if a separate area away from the working face has been designated in the permit (401 KAR 48:090 section 9), and
- a chipper can be used to significantly reduce the volume of brush and the potential settlement.

SMOLDERING WASTE

- empty load away from working face in the area designated in the permit (401 KAR 48:090 section 5),
- water down only as much as needed to completely extinguish as additional liquids will contribute to leachate,
- place in working face, compact and cover when no risk of fire remains, and
- exposed glass wastes have been known to start landfill fires on sunny days and should be covered with waste or soil promptly.

DUSTS

- Containerization or wetting is strongly recommended to prevent a hazard to exposed persons.

DRUMS

- may conceal hazardous waste or waste with free liquids,
- poor compaction may lead to uneven settlement and voids in the landfill
- must be open for inspection to ensure regulated hazardous waste or free liquids are not contained within
- sealed drums must not be opened or accepted for disposal by landfill personnel
- sealed drums may contain explosive vapors, regulated hazardous waste(s), or free liquids and
- return sealed drums to sender

WASTE STREAM TESTING

Before you dispose of certain wastes at your landfill, it is important to find out if you can accept those wastes at your landfill. By conducting a visual inspection of the waste, you cannot always determine if that waste is acceptable. Sometimes laboratory analyses are required to determine if a waste contains leachable material or if a waste is too wet. The two tests most commonly run on waste streams are the TCLP (toxicity characteristic leaching procedure) and the Paint Filter Test.

When a TCLP test is conducted, the waste stream is tested in a manner that reproduces the acidic environment of a landfill. The purpose of the test is to see how much of a particular constituent will leach out of the waste and potentially pollute the groundwater.

The paint filter test determines if a material contains free liquids. If a waste stream contains free liquids, it cannot be disposed of at a landfill. The waste must be processed or mixed with solids until it can pass the paint filter test before disposal is allowed.

METHOD 9095 - PAINT FILTER LIQUIDS TEST

1.0 SCOPE AND APPLICATION

1.1 This method is used to determine the presence of free liquids in a representative sample of waste.
1.2 The method is used to determine compliance with 40 CFR 264.314 and 265.314.

2.0 SUMMARY OF METHOD

2.1 A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the five-minute test period, the material is deemed to contain free liquids.

3.0 INTERFERENCES

3.1 Filter media were observed to separate from the filter cone on exposure to alkaline materials. This development causes no problem if the sample is not disturbed.

4.0 APPARATUS AND MATERIALS

4.1 Conical paint filter: Mesh number 60 (fine meshed size) - available at local paint stores such as Sherwin Williams and Glidden for an approximate cost $0.07 each.
4.2 Glass funnel: If the paint filter with the waste cannot sustain its weight on the ring stand, then a fluted glass funnel or glass funnel with a mouth large enough to allow at least one inch of the filter mesh to protrude should be used to support the filter. The funnel is to be fluted or have a large open mouth in order to support the paint filter yet not interfere with the movement to the graduated cylinder of the liquid that passes through the filter mesh.

4.3 Ring stand and ring or tripod.
4.4 Graduated cylinder or beaker: 100 ml.

5.0 REAGENTS

5.1 None

6.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

6.1 All samples must be collected according to the directions in the monitoring your landfill chapter of this manual.
6.2 A 100 ml. or 100 gram representative sample is required for the test. If it is not possible to obtain a sample of 100 ml. or 100 gram that is sufficiently representative of the waste, the analyst may use larger size samples in the multiples of 100 ml. or 100 gram (i.e., 200, 300, 400 ml. or gram). However, when larger samples are used, the analysts shall divide the sample into 100 ml. or 100 gram portions and test each portion separately. If any portion contains free liquids, the entire sample is considered to have free liquids.

7.0 PROCEDURE

7.1 Assemble test apparatus as shown in Figure 1.
7.2 Place sample in the filter. A funnel may be used to provide support for the paint filter.
7.3 Allow sample to drain for 5 minutes into the graduated cylinder.
7.4 If any portion of the test material collects in the graduated cylinder in the 5 minute period, the material is deemed to contain free liquids for purposes of 40 CFR 264.314 and 265.314.

8.0 QUALITY CONTROL

8.1 Duplicate samples should be analyzed on a routine basis.

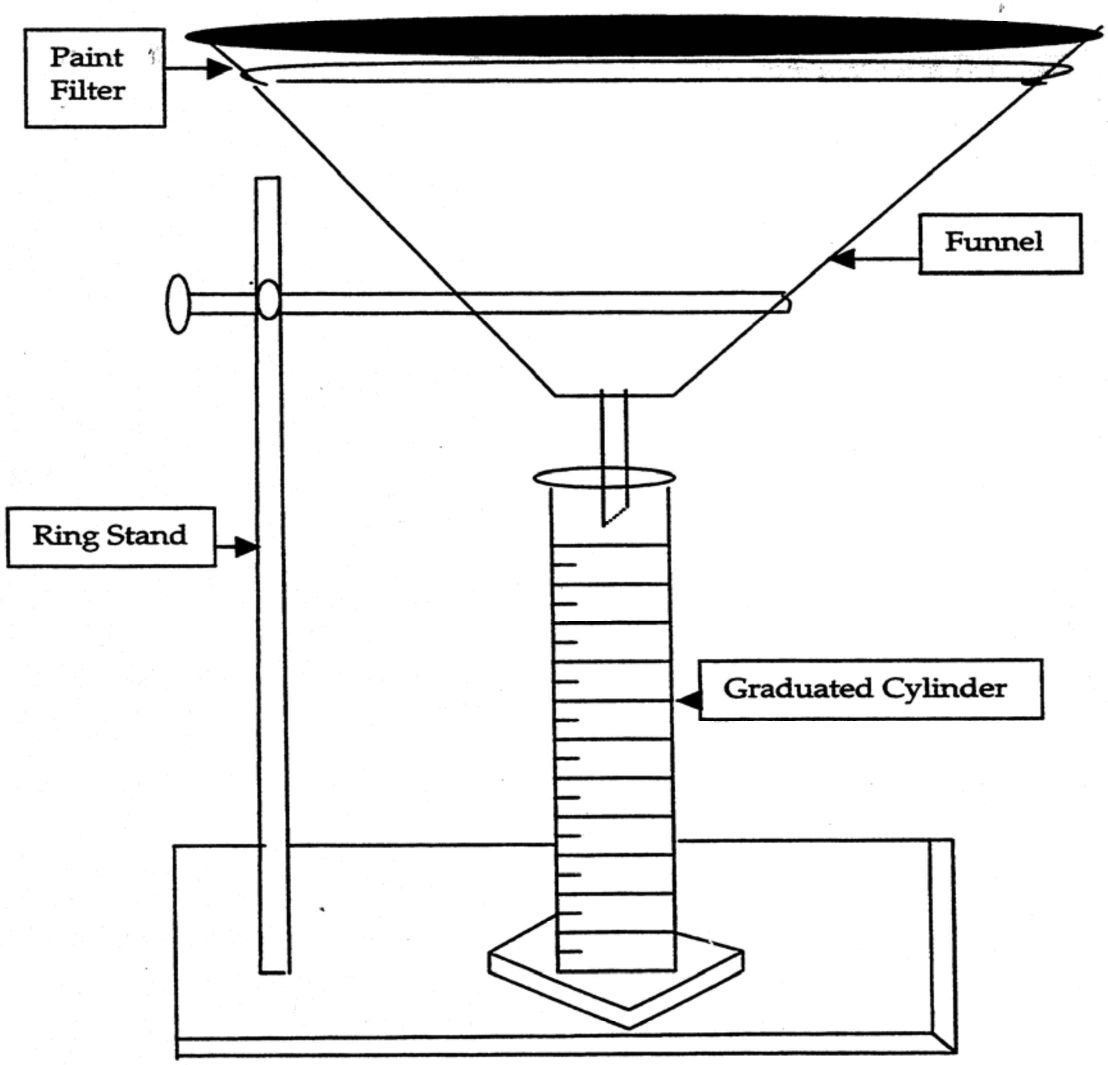
9.0 METHOD PERFORMANCE

9.1 No data provided.

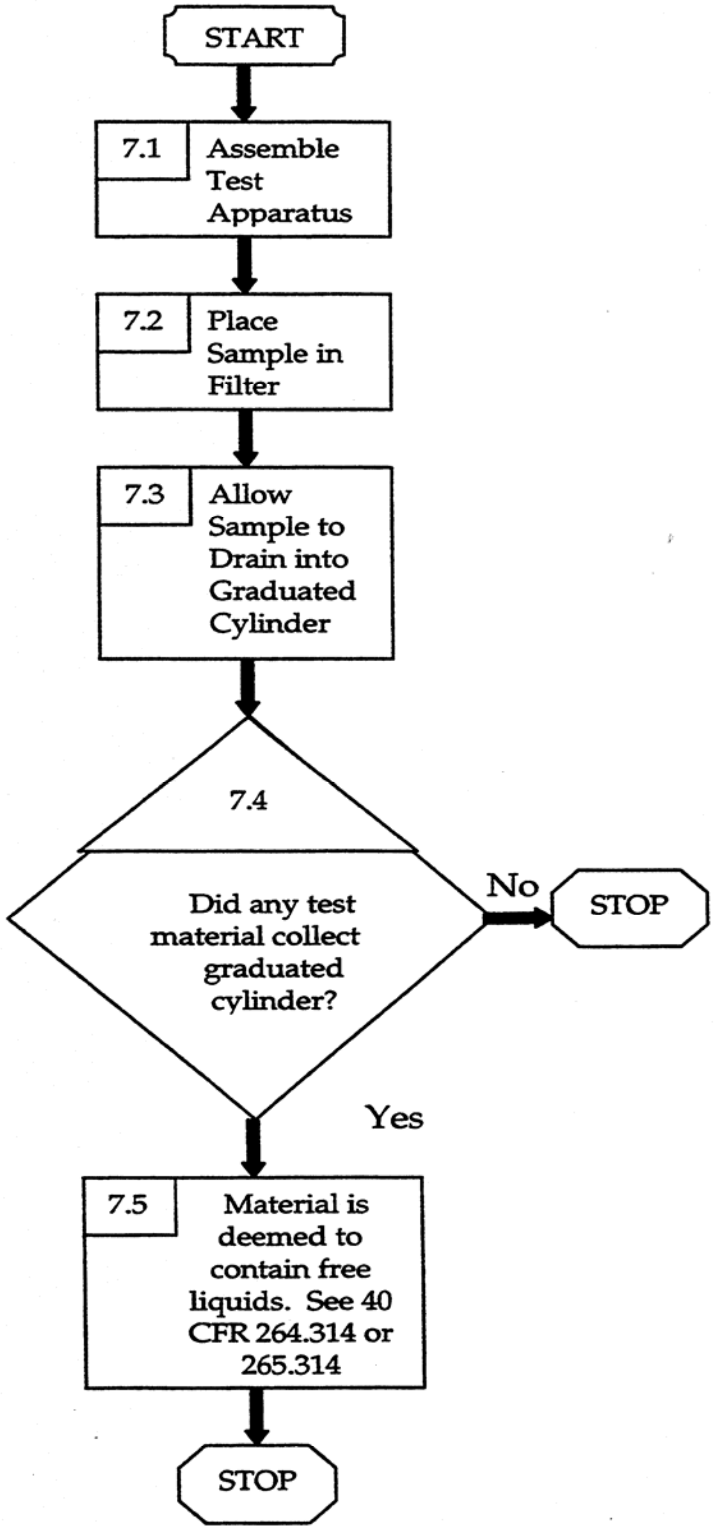
10.0 REFERENCES

10.1 None Required.

FIGURE 1 – PAINT FILTER TEST APPARATUS



METHOD 9095
PAINT FILTER LIQUIDS TEST



STUDY GUIDE
WASTE STREAMS/WASTE HANDLING

1. Name four characteristics of municipal wastes that necessitate proper handling and disposal.

   ____

   ____

   ____

2. Putrescible wastes will ____________ or _____________.

3. __________________ waste is generated by households.

4. __________________ waste is generated by stores, offices, and non-manufacturing businesses.

5. __________________ waste is generated by schools and hospitals.

6. ____________________ waste is generated as a result of building, remodeling, repairing, and demolishing buildings and other structures.

7. Non-hazardous liquids may be disposed of at a contained landfill.
   TRUE or FALSE

8. No further testing is required for sludges once they have passed the paint filter test and have been approved for disposal. **True** or **False** Why?

   ____

   ____

9. Whole tires generated by households may be placed in the working face. **True** or **False**

10. What is the most significant seasonal waste stream and what percent of the total waste stream does it usually represent?

    ____

11. Household hazardous wastes are acceptable for disposal at solid waste landfills even though they have the same hazardous properties as regulated industrial hazardous waste. List some examples of household hazardous waste.

____

____

____

12. What are the most important handling considerations when receiving and disposing of asbestos waste?

____

____

____

13. Sludges disposed of in a landfill cannot contain any ____________ ____________ and cannot be a ________________ material.

14. Materials containing more than ________ ppm PCBs cannot be disposed of in a contained landfill.

15. Contaminated soils must be analyzed using the ___________ test. This test proves that the soil is not a hazardous waste.

16. Petroleum contaminated soils, containing equal to or less than ________ ppm benzene, may be used for daily cover, if the material is not placed during a precipitation event.

17. List the five specific conditions and/or waste types that are unacceptable for disposal at a solid waste landfill.

____

____

____

____

18. The four characteristics of a hazardous material are:

____

____

____

19. Asbestos containing materials must be covered immediately with _____ to ______ feet of compacted waste.

20. Landfill employees must comply with _____________ standards when handling asbestos waste

21. Sludges must be placed in the ____________ _____________ and co-mixed with refuse unless an alternative method is specified in the permit.

22. Sludge can be used as daily cover. **True – False**

23. ________________, _________________, or __________________ bulky items is recommended before placement in the landfill.

24. If you receive or find smoldering or burning waste, you should:

____

____

____

25. Dust should be ___________ or ____________ to prevent a hazard to exposed persons.

26. ____________ ______________ wastes are generated by a manufacturing or industrial process that is not a hazardous waste or a special waste.

27. _______________ wastes are wastes of high volume and low hazard and include:

____

____

28. ______________________ wastes result from the operation of medical clinics, hospitals and other similar facilities.

29. A waste is classified as hazardous if it is ____________ or _____________ shows it meets the characteristic of a hazardous waste.

30. Conditionally Exempt Small Quantity Generator Hazardous Waste may be disposed of in a contained landfill if ____________________________ and _________________________.

31. ___________________ and __________________ are not acceptable at special waste landfills.

32. The two tests most commonly run on waste streams are the _________ _________ ____________ and _______________.

33. The ___________ ___________ ____________ is used to determine if a material contains free liquids.

CHAPTER 4
THE LANDFILL

This section describes performance standards that landfills must meet including the basic methods of operation, landfill development considerations, and regulatory requirements relative to the siting and design of a landfill.

A landfill is a solid or special waste disposal facility that is designed, operated, and closed in a manner, which complies with the Environmental Performance Standards. The Environmental Performance Standards (EPS), outlined in 401 KAR 47:030 for solid waste sites and 401 KAR 31:031 for special waste facilities, establish minimum requirements to ensure that waste sites or facilities do not pose an unreasonable risk for adverse effects on human health or the environment. Owners and operators of landfills must demonstrate compliance with the EPS outlined below. Sites that fail to meet these standards are considered open dumps, which are prohibited by law.

No solid or special waste site or facility shall:

- Restrict the flow of the 100 year flood, reduce temporary water storage capacity of the flood plain, cause a wash out of waste, cause or contribute to the taking of any threatened or endangered species (plants, fish, or other wildlife), destroy or adversely modify a critical habitat,
- Discharge pollutants, dredged or fill materials or cause the release of non-point source pollution into waters, including wetlands of the Commonwealth, contaminate an underground drinking water source beyond the point of compliance in excess of the maximum contaminant levels (see Section 6 of 401 KAR 47:030 and section 4 of 401 KAR 30:031),
- Exist or occur unless the onsite population of disease vectors is prevented or controlled,
- Open burn solid or hazardous wastes, or violate applicable air pollution requirements (see 401 KAR chapters 50 and 63),
- Allow the concentration of explosive gases to exceed 25 percent of the lower explosive limit for gases in facility structures or the lower explosive limits for gases at the facility property boundary,
- Pose a fire hazard,
- Allow uncontrolled public access, unauthorized vehicular traffic, or illegal dumping of wastes,

- Be a public nuisance due to blowing litter, debris, or other waste materials,
- Be newly located in a wetland, and
- Violate any requirement of KRS chapter 224.

The Cabinet may not grant a variance to these regulatory requirements.

LANDFILL DEVELOPMENT

By definition, a landfill is an engineered facility for the disposal of solid or special waste that complies with the EPS and regulations. "Engineered" means there are plans and specifications to be used for construction of the facility. Plans and specifications are a substantial part of the permit application.

DESIGN CONSIDERATIONS

Facility design is based on:

- Volume and type of waste to be disposed of in a given area,
- Available land and soil volumes and types,
- Expected compaction efficiency,
- Characteristics of proposed site with regard to water pollution and gas migrations, and
- Post closure care (park, golf course, limited farming such as livestock production).

The achieved compaction efficiency will directly affect the site's life and potential to produce contaminants. Kentucky regulations specify a compaction goal of 1,200 pounds per cubic yard. Due to high costs involved with site development and operation, it is wise to obtain high compaction efficiency. The degree of compaction obtained will vary based on the:

- Type of waste,
- Type of equipment,
- Wheel cleat width,
- Operational methods, and
- Condition of equipment.

Failure to consider facility design during operation may result in a reduction of disposal capacity and potential environmental problems.

SPECIFICATIONS

Specifications or permit application narratives are a written discussion of the methods and materials that will be used to construct the landfill. They contain performance criteria or engineering standards. Major items to be addressed in the specifications include:

- equipment/manpower needs,
- soils usage,
- life expectancy of the site,
- erosion control,
- potential problems/abatement measures,
- leachate control,
- monitoring,
- groundwater,
- surface water,
- methane or explosive gases, and
- gas control.

PLANS

Plans are engineering drawings that show:

- Existing site conditions:
    a. topography,
    b. streams and bodies of water,
    c. structures including residences,
    d. property lines, and
    e. drinking water wells, etc.
- The proposed sequence of the operation:
    a. drawn according to regulatory requirements,
    b. designed to efficiently manage storm water,
    c. designed to efficiently manage solid waste,
    d. minimized the amount of the bond for the "maximum open area", and
    e. protects public health and the environment.
- Design details for construction and site operation.

The use of construction plans takes the guesswork out of landfilling. Plans allow the operator to utilize the best excavation depth into soil for covering wastes. If the cut is too shallow, possible cover material will be left in the ground or the groundwater buffer may be too large and the fill zone too small, meaning the site will fill quicker than predicted. If the cut is too deep, the rock and earthen materials over the seasonal high groundwater table will be too small leading to possible groundwater contamination or even allow disposal of waste into the aquifer zone leading to probable groundwater contamination.

In addition, the use of plans allows the operator to track landfilling progress and to plan for future expansions. A keen manager will stay at least three years ahead of major expansion permit changes to keep the operation running smoothly. The time required for a new or horizontal expansion permit is normally:

- three to six months for a local governing body (fiscal court or 109 district) approval,
- twelve to eighteen months for consultant to obtain tentative cabinet approval of permit application, and
- twelve months for any formal hearing.

Other formal permit changes take about six months to one year.

There are six basic types of plan information that are necessary to show how a facility is to be developed. These are:

- existing conditions plan,
- site development plan,
- cross section plan,
- final contour plan,
- typical detail, and
- miscellaneous details.

Existing conditions, site development, and final contour plans are drawn using a "plan view". Plan view plans are drawn to depict the fill as if you were in an airplane and were looking down onto the surface of the earth.

EXISTING CONDITIONS PLAN

The purpose of this plan is to show the entire site and its characteristics prior to any site development. A plan scale of 1 inch = 100 feet or less is suggested for the drawing with contour intervals at no more than 2 feet. Different contour intervals, such as five feet, may be used in hilly or mountainous terrain with the approval of the Cabinet.

The first consideration in detailing the used of a site is to show the buffer zones. Buffer zones are the regulatory distances from the waste disposal boundary to specific points and must be identified. This plan must also identify:

- monitoring points for:
  - ✓ surface water,
  - ✓ groundwater, and
  - ✓ methane
- baselines,
- drainage patterns,
- screening,
- site location,
- roads,
- bench marks, and
- land use and zoning.

SITE DEVELOPMENT PLAN

The purpose of this plan is to show the entire site and its characteristics during and after site development. A primary use of these drawings is to determine closure bond amounts at different times during landfill operations and at final closure. Closure cost estimates is based on the "maximum open area" which depends on the larges construction phase and sequence of filling. A site development plan must be drawn using 2 foot contour intervals at a scale on 1 inch = 100 feet or less. The location and sequence of filling are shown as phases. These phases should be planned for twelve month duration periods and brought up to final grade as quickly as possible. This plan must also note:

- monitoring points,
- baselines,
- drainage,
- special construction material and techniques, and
- fencing and screening.

Maximum Open Area

The design engineer must calculate the area by:

- laying out the sequence of phases diagram,
- for each phase, drawing the final, interim and long term cover for all previous phases, and

- measure the area of the waste, daily, interim and long term cover not covered by final cap.

The largest non-capped area during the operations of the landfill is the maximum open area. The owner or operator must calculate the cost of closure for this area and post a bond to cover construction.

CROSS SECTIONS

The main reason for cross sections is to accurately calculate the future waste disposal volumes. Cross sections are drawn to show the landfill if you were to slice sections of the fill and look at the side of each slide. This would be similar to looking at different pieces of a loaf of bread to form an idea of the whole. Cross sections are referenced to elevation in feet above mean sea level. The vertical scale is different than the horizontal scale and slopes appear to be steeper than they are on cross sections. Cross sections should be drawn every 100 feet along the baseline at a scale of 1 inch = 10 feet vertically and 1 inch = 100 feet horizontally.

Cross section plans show the:

- depth and height of excavation and filling,
- distance to the water table from liner system bottom,
- liners,
- cover, and
- volumes.

FINAL CONTOUR PLAN

Final contour plans are normally drawn to a scale of 1 inch = 100 feet or less and contain 2 foot contour intervals. These plans show the proposed final use of the site. Slopes and drainage patterns are shown.

OTHER INFORMATION

Plans usually show typical details or blowups of special construction or design features. Details often include:

- monitoring systems,
- groundwater monitoring wells,
- different ditch cross section design,
- cell features,
- daily lifts,

- daily, interim, long term and final cover,
- liners,
- gas vents, and
- leachate collection systems.

Other construction items that need clarification are:

- access roads,
- utilities and drainage facilities,
- employee facilities,
- communication systems,
- fire protection equipment,
- equipment maintenance facilities, and
- surface water, groundwater and gas monitoring points.

All maps, plan sheets, drawings, isometrics, cross sections and aerial photographs submitted in the solid waste application are required by regulation to:

- be of an appropriate scale to show all required detail,
- be numbered, referenced in the narrative, titled, have a legend of all symbols, horizontal and vertical scales, and specify dates of development,
- use uniform scales,
- contain a north arrow,
- use USGS data as a reference for all elevations,
- contain a survey grid with a maximum dimension of 1,000 feet by 1,000 feet square based on field monuments which reference site specific bench marks,
- show the original topography and grid system versus the construction, operation and closure topography on separate plan sheets, and
- show survey grid location and reference major plan sheets on all cross sections (401 KAR 47:160 section 8(2).

GENERAL SITING REQUIREMENTS

SOLID WASTE LANDFILLS

Siting requirements (401 KAR 48:050) outlined below apply to all new residual, C/D/D and contained landfills.

Flood plains

Sites cannot restrict the flow of the 100 year flood or reduce the temporary water storage capacity of the flood plain. Operations methods at the site must prevent the washout of waste. New contained landfills will not be permitted in the 100 year flood plain.

Seasonal High Water Table

The lowest component of the bottom liner of a landfill must be at least four feet above the seasonal high groundwater table.

Buffer Zones

The distance between the fill area and the following must be:

- Property line — 250 feet
- Intermittent or perennial stream (unless a water quality certification is issued) — 250 feet
- Residence — 250 feet
- Feature of karst terrain (sinkhole) — 250 feet
- Gas, sewer, or water lines — 50 feet
- Unplugged wells (except monitoring wells) — 250 feet
- Wastes cannot be placed in the zone of collapse of deep mine workings or within the critical angle of draw of such workings.

Airports:

- No landfill may pose a hazard to aircraft due to birds,
- No new contained landfill will be permitted within 10,000 feet of an airport used by turbo jet aircraft or within 5,000 feet of an airport used by piston-type aircraft, and
- Under federal criteria, the owner of any new site within five miles of an airport must notify the airport and FAA.

Fault Areas:

- Waste cells cannot be located within 200 feet of a fault that has had displacement in Holocene time (i.e., within the last 10,000 years).

Aquifers:

No facility shall be permitted unless:

- The uppermost aquifer can be monitored to detect the constituents identified in 401 KAR 48:300 section 10 (the "big" list), and
- Corrective action can be performed on the aquifer as specified in 401 KAR 48:300.

SPECIAL WASTE LANDFILLS

Siting requirements, outlined below, apply to all new special waste landfills (401 KAR 45:130).

Flood Plains

Sites cannot restrict the flow of the 100 year flood or reduce the temporary water storage capacity of the flood plain. Operational methods at the site must prevent the washout of waste.

Buffer Zones:

The distance between the fill area and the following must be:

- Property line — 100 feet
- Intermittent or perennial stream (unless a water quality certification is issued) — 250 feet
- Sinkhole or other similar feature of karst terrain — 250 feet
- Wastes cannot be placed in the zone of collapse of deep mine workings or within the critical angle of draw of such workings.

Aquifers:

No facility shall be permitted unless:

- The uppermost aquifer can be monitored to detect the constituents identified in 401 KAR 45:160, and
- Corrective action can be performed on the aquifer as specified in 401 KAR 45:160

<u>TECHNICAL STANDARDS FOR LANDFILL DESIGN</u>

Kentucky's regulations will recognize four categories of fully permitted landfills:

- Special waste,
- Residual
- >1 acre construction/demolition/debris, and
- contained.

The design and closure standards for each category of landfill are specified by regulation and are meant to facilitate compliance with the Environmental Performance Standards.

As outlined in the "Permitting Process", the technical application, the third phase in the solid waste application process, is devoted to outlining the specific design of the facility. The special waste landfill application also contains design information as a part of the one step application process. This is accomplished through submittal of application narrative and engineering drawings and specifications.

This section outlines technical requirements applicable to all solid and special waste sites or facilities, plus the specific design and closure requirements for residual, construction/demolition/debris, contained and special waste landfills.

TECHNICAL REQUIREMENTS APPLICABLE TO ALL SOLID WASTE LANDFILLS

The contents of the technical application are based on the specific type of facility proposed but must include the following:

- engineering plans showing the design of the site and liner,
- design and operations narrative,
- closure and closure care plans, which outline the landfill cap design and a cost estimate for these activities. Prior to issuance of the construction/operating permit, a performance bond must be submitted which meets the requirements of 401 KAR 48:310,
- surface and groundwater monitoring plans which meets the requirements of 401 KAR 48:300, and
- construction quality control plan which outlines:
  - ✓ who will be responsible for each part of the quality control plan,
  - ✓ frequencies and specifications for inspections and tests,
  - ✓ forms to be used,
  - ✓ survey control system, and
  - ✓ a statement to be used for certifying that the quality control plan was followed by the owner.

This plan must also provide assurance that the layers of the homogeneous low permeability soil liners (clay) are compacted using nonvibratory compactors with full depth penetrating feet with a minimum of six passes per soil layer.

- Recordkeeping and reporting systems which adequately addresses the regulatory requirements relative to:
  - ✓ Construction quality control,
  - ✓ Annual surveys,
  - ✓ Surface water and groundwater sampling, and
  - ✓ Weight records.

Contained landfills are required to keep permanent records of the source, disposal locations, and quantity of spill residues and limited quantity generator hazardous wastes and source and quantity records on all other wastes. The owner would have a system tracking the disposal location of such unregulated hazardous waste:

- An “X-Y-Z” three dimensional grid system tied to a benchmark, or
- A note on the daily waste disposal report if the working area is tied to a coordinate system.

Contained landfills meet Federal “Subtitle D” requirements for Municipal Solid Waste landfills. As such, they are designed to meet requirements for disposal of household hazardous waste (HHW) and conditionally exempt small quantity generator (CESQG) hazardous waste. Generally speaking, a company or business may not produce more than 100 kg. (220 pounds) of waste that contain hazardous constituents at any one location unless they register as a hazardous waste generator. Please refer to 401 KAR 31:010 section 5 for the definitions and requirements for conditionally exempt small quantity generators. The plastic liner, clay liner and extensive groundwater monitoring guards against escape of these chemicals, according to U.S. EPA. Therefore, the Cabinet encourages landfill owners to provide a disposal site for Kentucky’s small quantity hazardous waste as a service to its customers.

RESIDUAL LANDFILLS

DESIGN REQUIREMENTS

As discussed in “The Permitting Process”, residual landfills are designed and operated for the disposal of a specific type waste; thus, each design will vary. The regulations specify that the engineering design must be capable of meeting the

Environmental Performance Standards, siting standards and consider the following:

- Volume to be disposed,
- Climate of area,
- Permeability of the liner material,
- Type of soil(s) underneath the facility,
- Hydrogeologic characteristics of the facility; including quality, quantity, current use and direction of groundwater flow,
- Proximity of the site to surface water and groundwater,
- Potential for gas emissions and odors,
- Design of the leachate, runoff and gas migration control systems relative to the specific waste to be disposed, climate and volume of leachate to be collected, and
- Characteristics of the waste – including how the liner and cover material will prevent hazardous chemicals from contaminating groundwater and surface water. A good rule of thumb is to use clay for waste containing only metals and a composite liner (clay and synthetic) for wastes containing organics. Otherwise, the engineer should model the effects of any hazardous substance migration through the liner and into the groundwater. Use the EPA help, ODAST, MODFLOW or similar to predict groundwater impacts of the given design.

To determine groundwater monitoring parameters, the applicant should:

- Do a waste analysis for those substances on the list in:
  - ✓ 40 CFR 264 Appendix IX (also 401 KAR 34:360),
  - ✓ 401 KAR 48:300 section 10 (the "big" list), or
  - ✓ the list of priority pollutants, or similar list.
- List any chemicals at concentrations above the detection limit for use in characterization groundwater monitoring,
- Chose several of the higher concentration organics and metals as "markers" for quarterly detection groundwater monitoring, in addition to the indicator and metals parameters specified in 401 KAR 48:300 section 11(2) for Residual and Construction/Demolition/Debris landfills, and
- Use the "markers" for modeling the liner and cap performance with regard to protecting groundwater.

CLOSURE AND CLOSURE CARE REQUIREMENTS

As part of the technical application, the applicant is required to develop closure plans for the site to ensure compliance with the Environmental Performance Standards. A residual landfill closure plan must address:

- Type and amount of waste in the facility,
- Mobility and expected rates of migration of the waste and leachate,
- Site:
    - ✓ Location,
    - ✓ Topography,
    - ✓ Surrounding land use, and
    - ✓ Final site use.
- Climate,
- Characteristics of the cover material, such as:
    - ✓ Composition,
    - ✓ Erodibility (ability to wash out),
    - ✓ Slope stability,
    - ✓ Surface contours (hilliness),
    - ✓ Thickness,
    - ✓ Porosity (the amount of holes or holiness),
    - ✓ Permeability (ability to slow water flow),
    - ✓ Slope,
    - ✓ Length of run of slope, and
    - ✓ Type of vegetation to be used.
- Geologic profiles,
- Soil profiles,
- Surface water flow, and
- Subsurface hydrology.

Once the facility owner quits accepting wastes, he begins to cap the landfill. When the construction is completed, the owner notifies the Division whom must inspect the site. A DWM representative inspects the site and reviews the records to determine the site's compliance with all regulatory requirements. A ninety percent permanent vegetation cover must be in place before the request for a final construction inspection is made.

After the Division accepts the owner's closure report, the facility must be maintained and monitored for a minimum of two years. This period is referred to as the closure care period. Once the two year closure care period expires, a DWM representative must inspect the site and review the records to determine the site's compliance with all regulatory requirements and that a ninety percent permanent vegetation cover exists. If the site is in compliance, the Division may release the closure and closure care bonds per 401 KAR 48:060 section 3(6) and KRS 224.40-650(3).

The owner or operator must implement this plan, plus any other corrective work specified by the Division, according to the closure care schedule. The deed for the property has to be altered to notify future purchasers of the following:

- Location of the waste disposal area,
- Time of operation of the facility,
- Nature of the waste, and
- Caution against future disturbance.

Once this work has been accomplished, the Division may accept the closure care certification prepared by the owner or his representative.

CONSTRUCTION/DEMOLITION/DEBRIS LANDFILLS

DESIGN REQUIREMENTS

Technical requirements specified for C/D/D landfills are outlined in 401 KAR 48:060. These requirements are the bare minimum of standards that must be met. This means that the design and closure plans submitted must at least meet the following criteria:

- They must be designed to keep surface water flows and leachate separate by:
  - ✓ Minimizing surface water running onto or through the operational or completed fill areas,
  - ✓ Designing diversion ditches and structures for a 100 year/24 hour storm flow (about 6 to 7 inches of rain), and
  - ✓ Designing sediment basins (silt pond) and emergency spillways:
    - o To retain and safely pass a 25 year/24 hour storm event (about 4 to 5 inches of rain),
    - o To pass a 100 year/24 hour storm event (about 6 to 7 inches of rain) through the emergency spillway (ditch to carry the extra water that would have broken the dam) with no flow exceeding the design freeboard (i.e., space between the top of the water and top of the ditch),
    - o To allow sediment storage from an operating period of one year (one may use shorter times with a more frequent clean out schedule),

    - With specified sediment basin clean out elevations (i.e., time to remove the soils when the top of the dirt reaches this mark), and
    - Using designs verified by a unit hydrograph method of calculation (an engineering method to calculate flow).
- **Liner and leachate collection systems** must be designed with the following:
  - ✓ The bottom liner, covering the bottom and sidewalls, consisting of:
    - 12 inches of soil, and
    - 12 inches clay with 1 x 10^{-7} centimeters per second maximum permeability or its equivalent (i.e., ten years for one foot of water to break through the bottom of one foot of clay).
  - ✓ Leachate collection system in areas with a slope of less than 25 percent which:
    - Have a drainage layer of 12 inches of material with a minimum permeability of 1 x 10^{-3} centimeters per second or its equivalent (i.e. sand),
    - Is designed for a maximum head (standing water depth) of 12 inches,
    - Used four inch diameter, perforated lateral pipes which are:
      1. installed perpendicular (right angles, or 90°) to flow, and
      2. with the piping layout having a minimum slope of one percent.
    - Uses an 8 inch diameter pipe for trunk lines, and
    - Has a filter fabric (i.e. cloth) or other material design to protect the integrity of the drainage layer, and a filter fabric protection layer of 12 inches of material with a minimum permeability of 1 x 10^{-3} centimeters per second or its equivalent (sand). The Cabinet frequently waives these two requirements if the applicant can show equivalent environmental protection (little or not clogging of the sand by the waste constituents).
- The leachate collection tank with 1,000 gallons minimum plus storage volume for fifteen days of peak production capacity during operation or closure using the HELP (Hydraulic Evaluation of Landfill Performance) Model. This is usually the wettest fifteen day period during 20 years of area rainfall data,
- A description of how the leachate will be measured disposed of and documented. If using an off site wastewater treatment plant, provide an approval letter from the owner of the treatment facility,

- Adequate solid material must be documented to provide coverage of one foot of compacted cover at the end of the week or on lifts of 10,000 square feet area, whichever occurs first (for example, if you spread 20,000 square feet of wastes in one week, you must apply cover twice),
- Surface and groundwater monitoring plan which meets 401 KAR 48:300,
- Equipment sufficient to handle waste stream,
- Identify an area for handling hot or smoldering load and other special handling problems, and
- Include a shelter for operating personnel, which has potable water, sanitary facilities, lights, heat and screened windows.

When the applicant restricts the waste to non-putrescible wastes and wastes that will not leach, the liner may be modified to consist of:

- Two feet of soil re-compacted to 90 percent standard proctor, and
- No leachate collection system.

Non-putrescible means tightly baled paper or cardboard, wood boards, logs, stumps, asphalt, concrete, etc. Putrescible means anything subject to rapid decomposition such as loose paper or cardboard, wood shavings or chips.

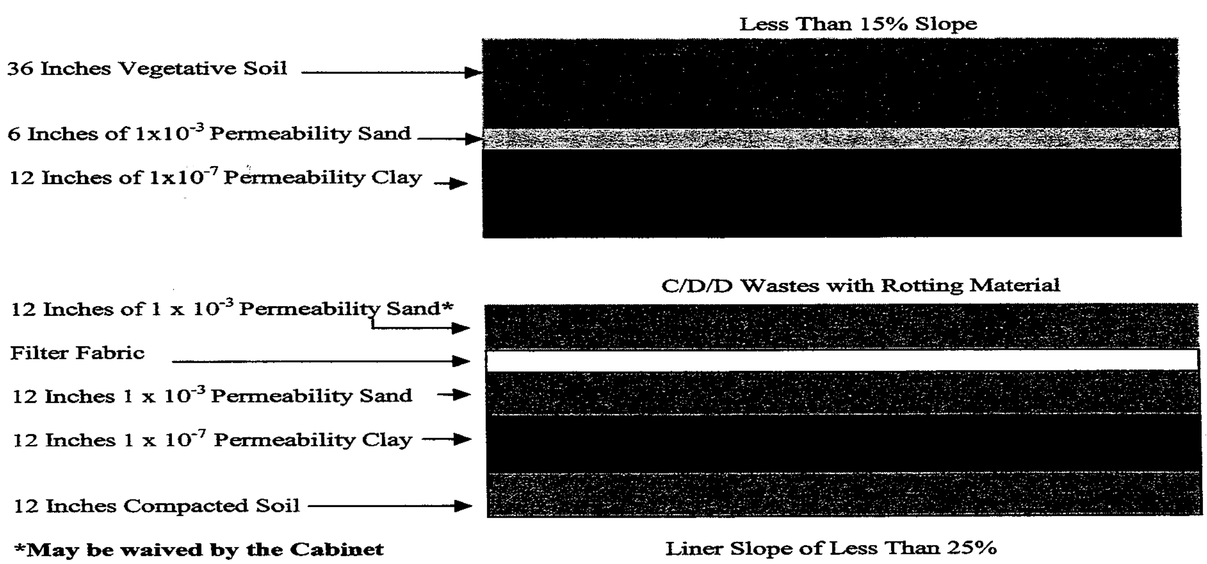


Figure 4-1 Outlines the Minimum Liner and Cap design Described

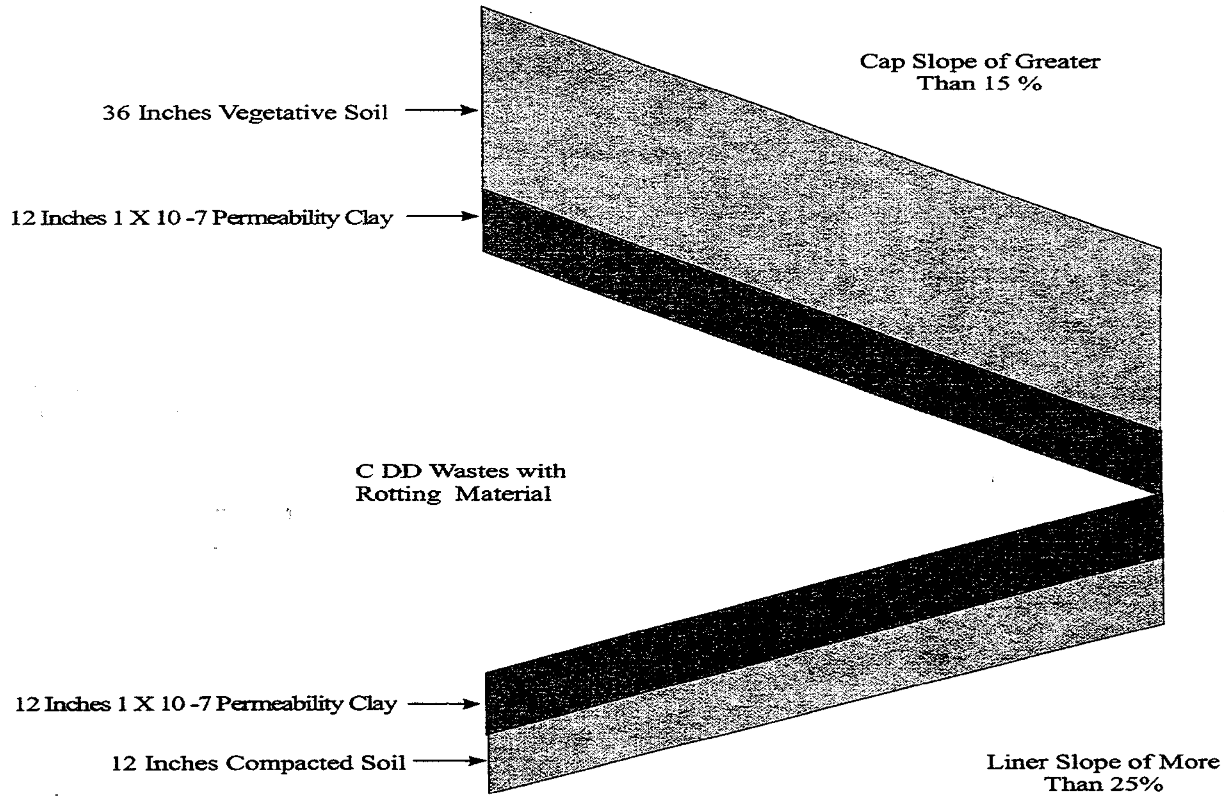


Figure 4-1b
Construction-Demolition Debris Landfill
Putrescible Wastes Design Cross Section
On Slopes

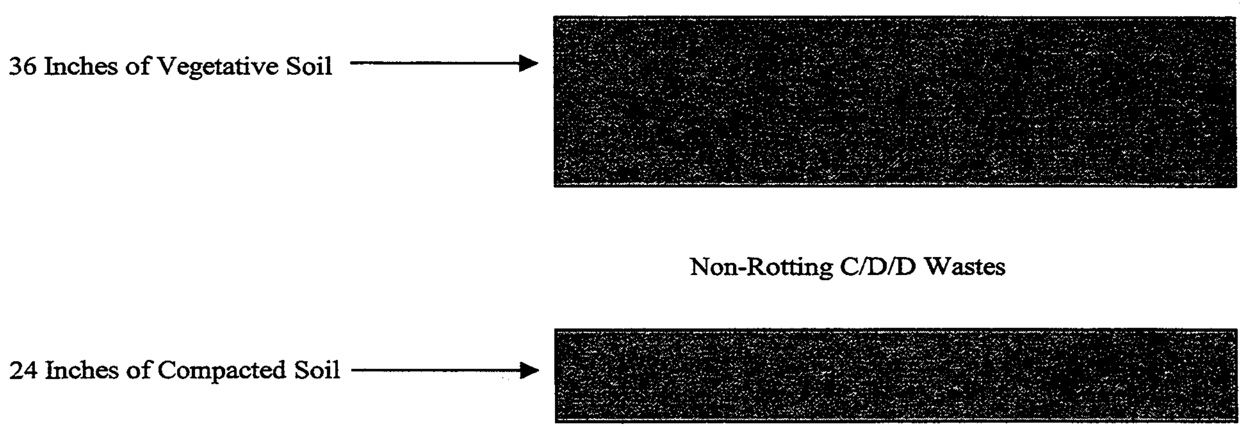


Figure 4-1c
Construction/Demolition/Debris Landfill
Non-Putrescible Wastes Design Cross Section

CLOSURE AND CLOSURE CARE REQUIREMENTS

The technical application requires the applicant to develop a closure plan, which describes:

- The procedures and schedule for final closure,
- The phased closure and sequence, and
- The final cover designed to meet the following (starting with the first layer above the interim cover):
  - ✓ Waste cells graded to a slope of more than 5 and less than 25 percent,
  - ✓ 12 inches of a minimum 1×10^{-7} cm/sec permeability clay or its equivalent,
  - ✓ on slopes of less than 15 percent, six inch drainage layer of 1×10^{-3} cm/sec permeability sand with a system of drainage tiles to relieve water collected,
  - ✓ Filter fabric to protect the drainage layer,
  - ✓ Three feet of vegetative cover,
  - ✓ Diversion berms for locations where the runoff exceeds the holding capacity of the final cover, and
  - ✓ When the wastes in the landfill have been restricted to non-putrescible wastes or wastes that don't leach, the final cover layer may be reduced to a minimum of 3 feet of vegetative soil.

Closure regulations require the owner or operator to:

- Implement the closure plan and schedule. The owner or operator may submit a modification 90 days prior to the last date for accepting waste,
- Place final cover within 365 days over areas of the landfill which are completely filled (reached the final grade or maximum planned elevation),
- Not remove earth moving equipment until the Division inspects the site and determines compliance with approved plans and specification,
- Submit the records that the owner shall submit to verify quality control of the cap,
- Alter the deed to caution against future site disturbance of the area and proof of this change provided,
- Obtain the bond release two years following the Division's acceptance of the closure certification,
- Maintain the sign which lists the name, address and telephone number of the owner during closure care (401 KAR 48:060 section 2(5)),

- Perform corrective action work as specified by the Cabinet after the final cap inspection, and
- Follow the closure care plan for a minimum of 2 years which includes narrative on the activities to be undertaken after closure relative to:
    - ✓ Surface and groundwater monitoring,
    - ✓ Leachate collection and treatment,
    - ✓ Cap erosion and sediment control,
    - ✓ Cap re-vegetation and regarding,
    - ✓ Access controls, and
    - ✓ A schedule for monitoring and accomplishing these activities.

Registration of less than one acre sites for C/D/D wastes holds down the demand for full permits. The Cabinet added requirements in September of 1999 in 401 KAR 47:110 and the new 48:320. New regulations require that:

- The owner undergo a five day waiting period before the registration automatically takes effect to allow the Cabinet to check the background (compliance record) of the applicant,
- That the applicant publish a newspaper notice two weeks before submission of the registration,
- The Cabinet to hold a public meeting upon the request of any individual,
- The applicant to prepare a Groundwater Protection Plan (GPP) per 401 KAR 5:037,
- No two landfills be within 750 yards, and
- For landfills within a wellhead protection area (WPHA), as defined in 401 KAR 5:002 section 1, shall construct and maintain a liner and leachate collection system:

    - ✓ **The Liner**
        - o Is a low permeability soil component with a minimum of twelve contiguous inches of 1 x 10^{-7} cm/sec maximum permeable material (clay) or its equivalent, and
        - o Covers the bottom and sidewalls of the facility with the bottom liner sloped toward the leachate collection system that complies with subsection 3 of this section.
    - ✓ **The leachate collection system**
        - o Must have a minimum of a twelve inch layer of gravel or a layer of equivalent performance and a toe drain, and
        - o Discharges into a collection tank with a minimum capacity of 1,000 gallons.

For more information on WHPA contact the Groundwater Branch at (502) 564-3140.

CONTAINED LANDFILLS

DESIGN REQUIREMENTS

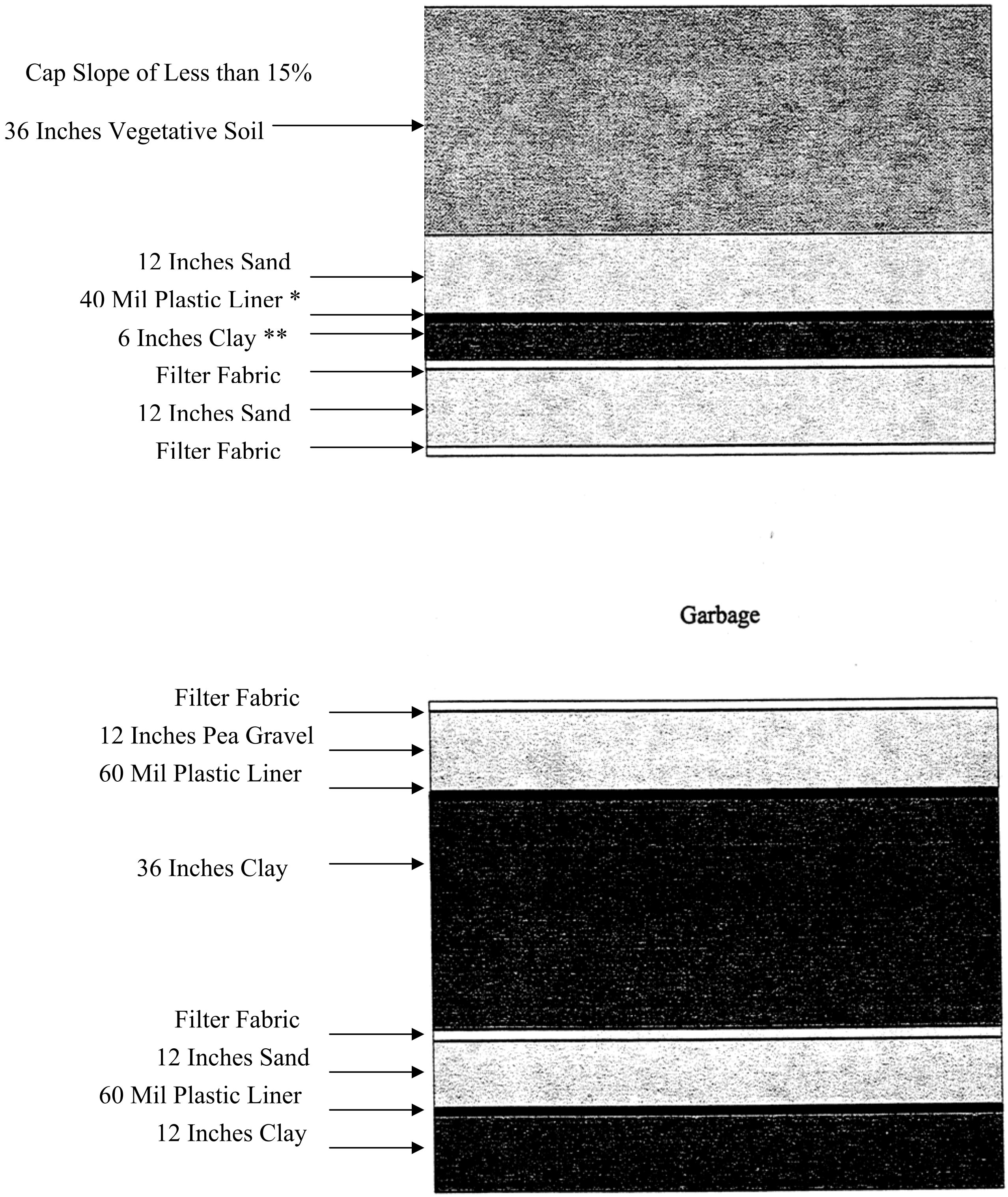
Design requirements for contained landfills are outlined in 401 KAR 48:070 and 48:080. These chapters outline the minimum design standards for the liner and cap. Owners or operators must ensure that the narrative and design:

- Maintains the separation of surface water and leachate. The contours of the landfill must minimize the surface water that runs on or through the landfill,
- Allows ditches to withstand a 100 year, 24 hour storm flow (runoff from a 6 to 7 inch rainfall),
- Meets the following requirements for sediment basins:
  - ✓ The emergency spillway must pass a 100 year, 24 hour storm event without over flowing,
  - ✓ The storage and principal spillway discharge must not flow into the emergency spillway (ditch that carries water that would have washed away the dam) during a 25 year, 24 hour storm event (rainfall of 4 to 5 inches),
  - ✓ The pond must have a one year sediment (silt) storage volume,
  - ✓ The flow must have verification by the unit hydrograph method of calculation, and
  - ✓ The downhill toe of the slop of the sediment pond dam must be 50 feet from the property line
- Enables the landfill to resist the maximum anticipated horizontal acceleration in lithophytic material if it is constructed in the seismic impact zone,
- Ensures the stability of the system components (i.e., liner, leachate collection system, cover) for landfills located in unstable areas (i.e., karst, underground mines, unstable slopes),
- Ensures that sufficient equipment be onsite to compact wastes received within 2 hours. Backup equipment must be available within 24 hours. A recordkeeping system must be proposed to address equipment maintenance.
- Ensures an in-place waste density of at least 1,200 pounds per cubic yard,
- Addresses soil availability to meet the liner and cap construction needs (clay volumes and permeability),
- Includes a building for personnel which:
  - ✓ Heated
  - ✓ Air-conditioned or screened, and

  - ✓ Potable water and sanitary facilities.
- Includes a building which is large enough to hold the larges piece of equipment for maintenance,
- Ensures that each building has a monitoring alarm system to detect explosive gases,
- Outlines a quarterly methane monitoring program which addresses:
  - ✓ The control of explosive gases per EPS of 401 KAR 47:030,
  - ✓ Soil and water properties of the area around the landfill,
  - ✓ Location of facility structures and boundaries,
  - ✓ Gas venting system with minimum of one vent per acre, and
  - ✓ Location of surrounding off site structure and residences.
- Meets the following roadway requirements:
  - ✓ Construction of a road from the publicly maintained highway to the waste disposal area,
  - ✓ Construction of an all weather perimeter road (gravel or paved) around the landfill to each monitoring and sediment control structure,
  - ✓ Internal roads must be all weather and designed to within 200 feet of the working face,
  - ✓ All roads must be designed wide enough to allow passage of vehicles, carry normal traffic, and properly drain, and
  - ✓ Entry to landfill must have enough space to safely accommodate trucks and prevent delays on the public roadway (include stacking lanes).
- Has a safety and communication plan which addresses:
  - ✓ Heavy equipment safe operation and maintenance to prevent accidents and breakdowns, and
  - ✓ Description of:
    - o Communication equipment such as radios, mobile phones and base telephones,
    - o Fire fighting procedures, and
    - o OSHA related requirements.
- Has scales to weigh all waste,
- Has an adequate:
  - ✓ Tank storage based on predicted leachate volumes,
  - ✓ Method of leachate measurement,
  - ✓ Liquid removal schedule, and
  - ✓ Treatment method
- Has a <u>liner</u> containing (starting from the bottom and going up):

- ✓ A <u>sub-grade</u>: the landfill sub-grade is the upper rock layer, soil layer, or select fill that is the foundation to support the liner. This sub-grade must be:
    - Graded according to plan,
    - Sufficiently dry and stable,
    - Free of organic material, and
    - Verified by a minimum of 9 tests per acre to determine sub-grade compaction. Sufficient cross sections must be taken to document the finished elevation.
- ✓ For any areas of less than 10 percent slope, <u>a secondary composite liner</u>, which must consist of:
    - A 12 inch thick clay layer with a permeability of 1×10^{-7} cm/sec (i.e. takes ten years for one foot of water to penetrate),
    - Synthetic liner with a nominal thickness of 60 mils (a mil is one thousandth of an inch),
    - A 12 inch drainage layer with a permeability of 1×10^{-3} cm/sec (sand), and
    - Filter fabric
- ✓ For all area, a <u>primary composite liner</u> with:
    - A 36 inch thick clay layer with a permeability of 1×10^{-7} cm/sec,
    - A 60 mil thick synthetic liner,
    - A 12 inch drainage layer with a permeability of 1×10^{-3} cm/sec (sand),
    - A filter fabric to protect the drainage layer,
    - Geonet composite, a synthetic drainage netting glued to upper and lower filter fabrics, may replace the drainage layer on slopes greater than ten percent, and
    - Geosynthetic Clay Liner (GCL) on two foot thick clay sub-grade may replace the 36 inch Compacted Clay Liner (CCL).
- ✓ A <u>leachate collection system</u> that uses:
    - A maximum static head of 12 inches of depth,
    - Eight inch diameter schedule 80 plastic pipe for the main collection lines or another design that meets the 12 inch maximum leachate depth rule,
    - Four inch lateral lines installed perpendicular to flow or another design that meets the 12 inch maximum leachate depth rule,
    - A design for the pipes to withstand all encountered static and dynamic load (dead and live loads),

- A one percent minimum slope for piping,
- A leachate collection tank with 1,000 gallons plus 15 days at peak production rates during operation or closure (using the HELP Model),
- An identified and assured disposal method (letter of acceptance from an off site Publicly Owned Treatment Works (POTW)), and
- Allowances for inspection and cleaning.

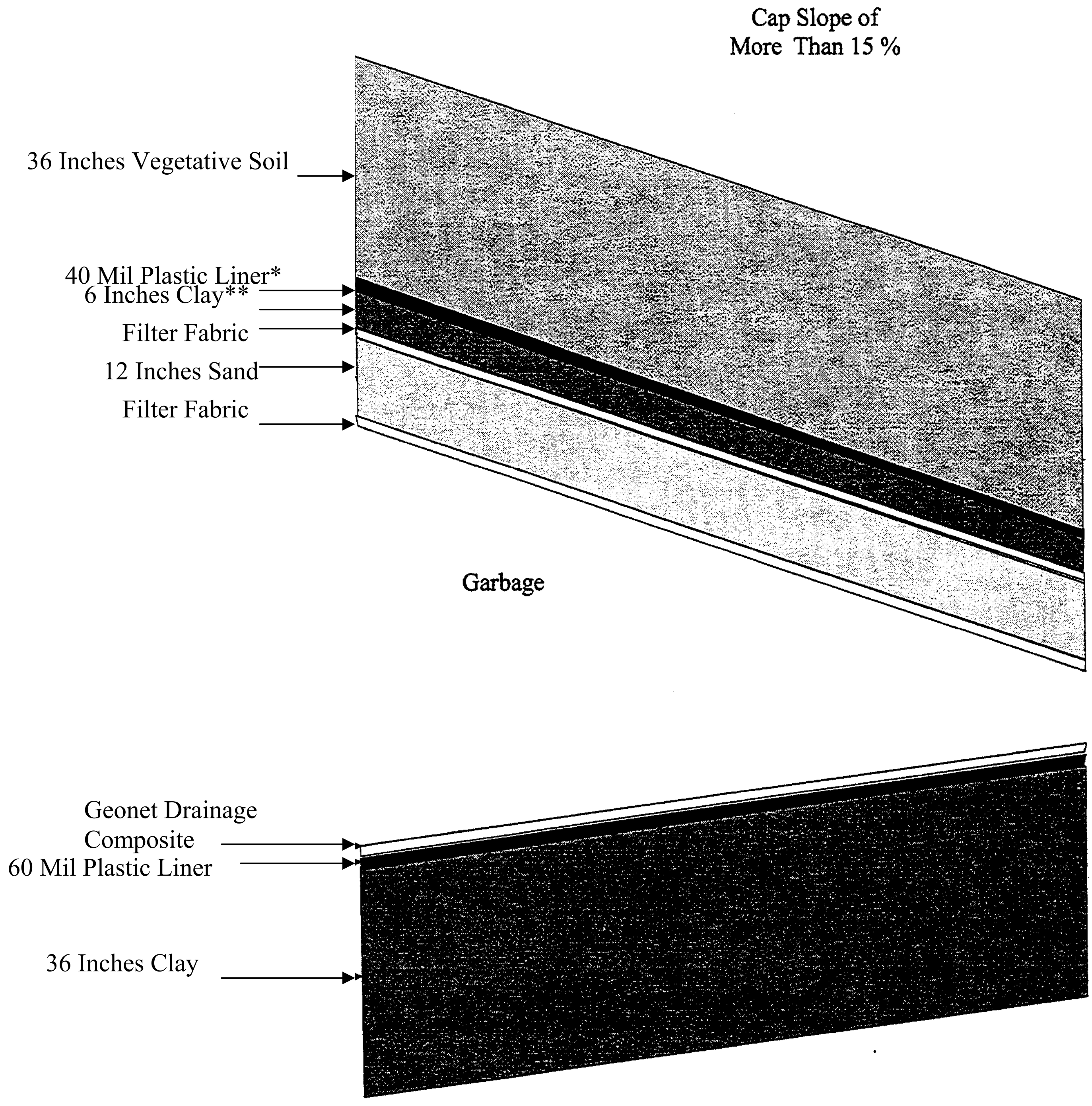


* Required when plastic present in bottom liner

** Required by Cabinet

Figure 4-2a
Contained Landfill Design
Cross Section Flat Areas

Liner Slope of Less than 10%

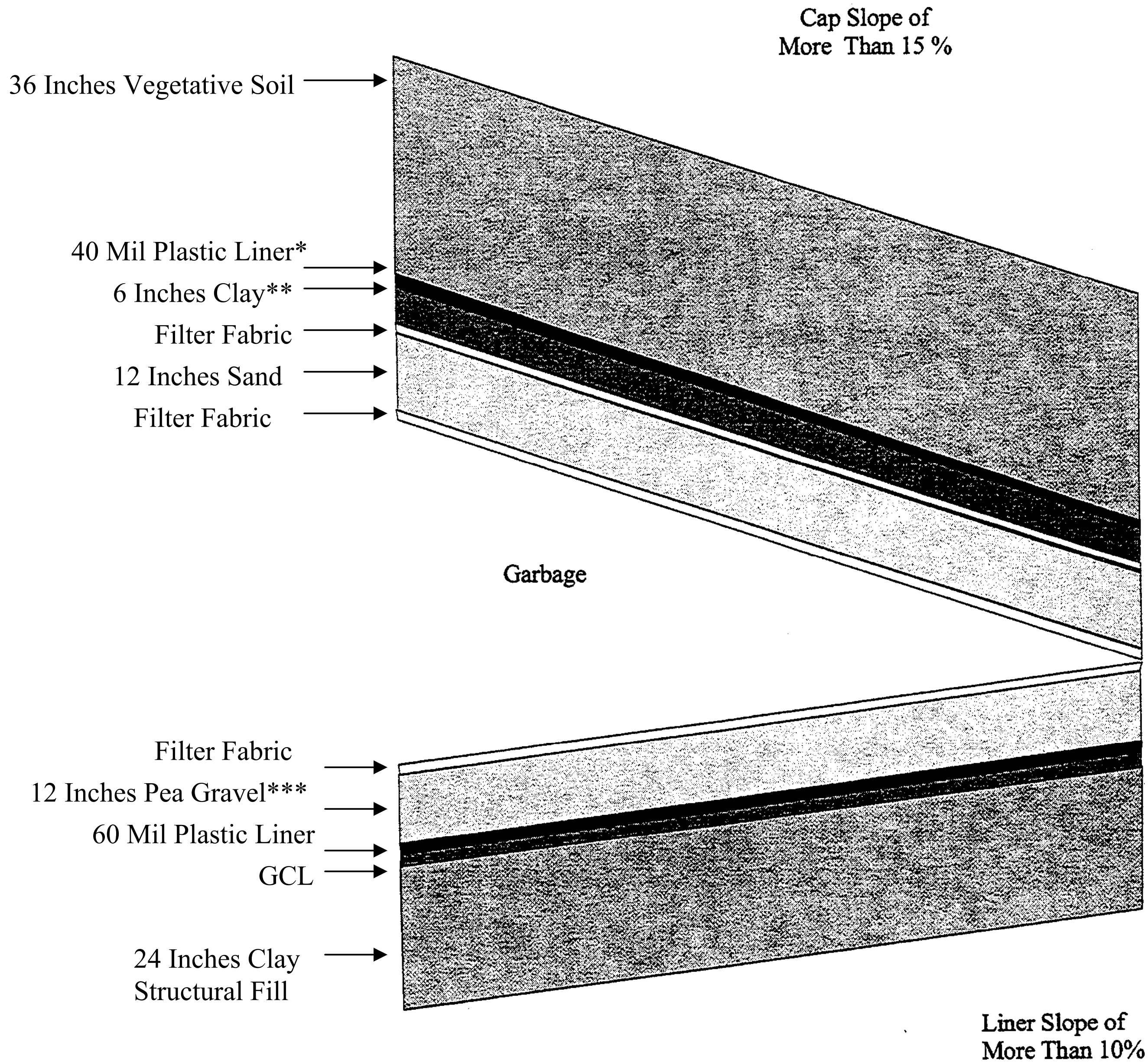


* Required when plastic present in bottom liner

Liner Slope of More than 10%

** Required by Cabinet

Figure 4-2b
Contained Landfill
Design Cross Section
Sloped Areas



* Required when plastic present in bottom liner

** Required to plug Microholes

*** Required for Flow and Liner Protection

Figure 4-2c
Contained Landfill
Design Cross Section
Geosynthetic Clay Liners (GCL)

The recent past has documented several problems with the design and operation of leachate collection systems at contained landfills. Failure to divert rainfall runon and runoff away from the leachate collection layer overloaded the systems with rainwater and dilute leachate that nevertheless must be transported to a POTW for disposal (similar to mixing storm water and sewage). This results in an enormous increase in hauling and treatment costs or increases temptation to directly discharge to a stream. One company performed an open dump clean up work over one million dollars in response to illegal discharges. Solutions include:

- The design and installation of plastic liner flaps between the new liner area and the current disposal area,
- Construction of a smaller cell since plastic encourages runoff (one year maximum is recommended),
- Installing partial berms between cells to separate leachate flows from filled area from surface water in new areas,
- Covering the entire new cell with waste and interim cover while directing rain water (runoff) from the top of the interim cover through the sediment pond,
- The design and installation of a drain pipe through the “dam” at the bottom of the landfill for storm water gravity flow (less expensive than pumping but must seal prior to filling),
- The design and installation of temporary runoff ditches from the covered working area to the main runoff ditches connecting to the sediment pong (Designed by a Professional Engineer per 401 KAR 48:070 section 7(2)(C)), and
- Partnering the consulting engineer and the manager to sequence filling, i.e., onsite visits to look at the current situation and plan a way out for the storm water as filling progresses.

METHODS OF OPERATION

- Prepare line,
- Plan to deposit refuse at bottom of slope for best control of surface water and blowing litter,
- Prepare a waste dumping berm high enough for the protective layer and first waste layer,
- Spread refuse using light weight equipment (such as a D-5 or equivalent), and
- Continue placing next lift normally using a landfill compactor.

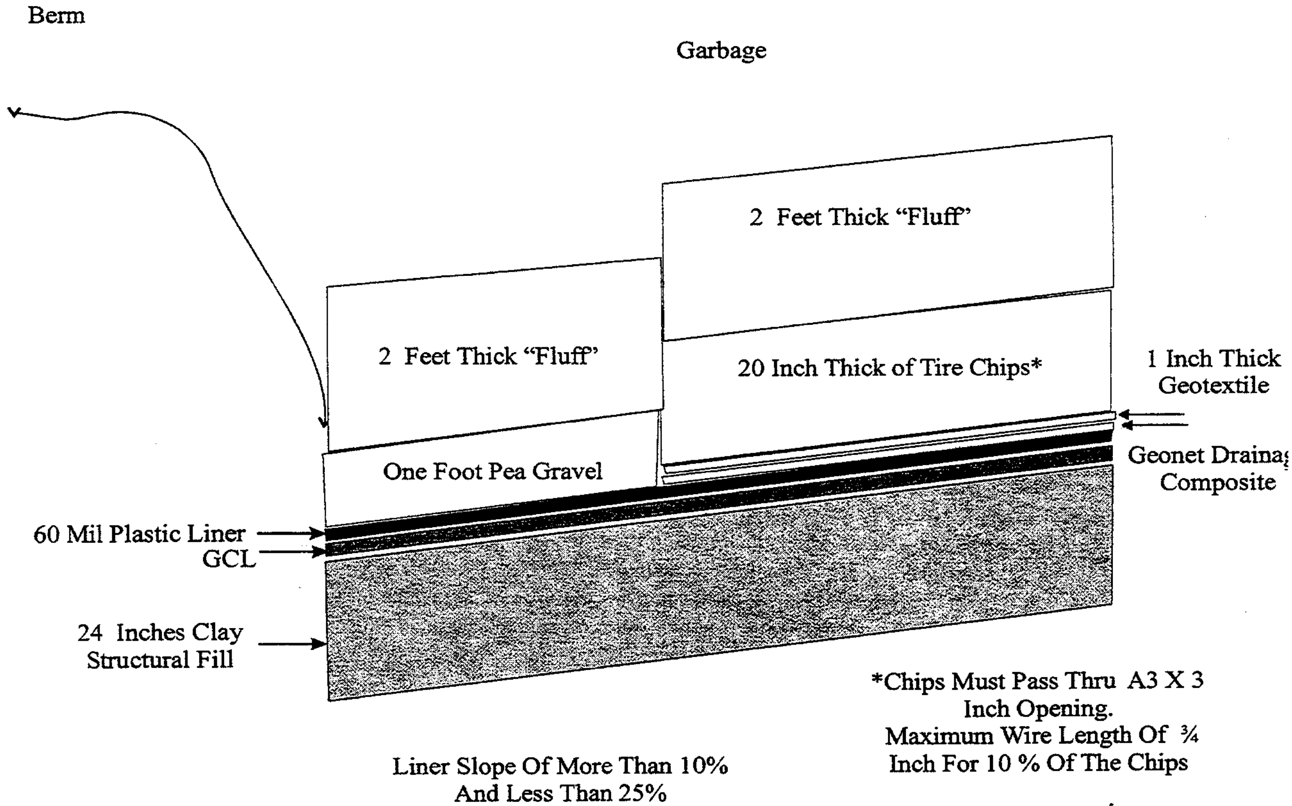


Figure 4-3
Contained Landfill
Starter Berm and Liner Protection
Sloped Areas

LINER PROTECTION

The Cabinet requires protection of the newly constructed contained landfill liner to prevent boards, pipes and other potentially damaging material from puncturing the plastic and clay system. This is even more important as more designers specify GCL and geocomposite drainage netting instead of CCL and one foot of gravel. The new clay material, while much more resistant to water infiltration, is much thinner than the traditional clay liner. The GCL is typically less than one-half inch thick compared to the thirty-six inch thick normal liner. The drainage net is also much thinner. The Cabinet has sent the following correspondence on the issue:

- September 15, 1999 Notice to All Contained and C/D/D landfills,
- November 17, 2000 letter to each contained landfill, and
- December 21, 2000 letter to each contained landfill.

A copy of each is in the appendix. The options for GCL/geonet liner protection include:

- ✓ Placing six to twelve inches of sand or gravel on top of the GCL/drainage net,
- ✓ Placing two feet of "fluff" free of any damaging objects, such as boards or pipes, on top of the twelve inch thick drainage layer or sand/gravel protective layer. This may require:
    - o Route management so that haulers pick up none of these objects during fluff layer placement,
    - o Diversion of C/D/D waste trucks to the C/D/D landfill unit,
    - o Spotters to remove objects on the floor of the cell to remove damaging objects, and
    - o Use of a D-5 or equivalent or smaller equipment for spreading.
- ✓ Use of tire derived chips (TDC):
    - o Place a cushion layer of one inch thick filter fabric or six inches of sand or gravel over the Geosynthetic drainage netting/GCL, and
    - o Place 20 inches of TDC with 80 percent passing three inch nominal and 90 percent having less than or equal to ¾ inch long wire.

FINAL CAP

The cap is a layered system which must maintain a slope between five and twenty-five percent. The components of the cap are (from bottom to top):

- Filter fabric,
- Twelve inch thick sand gas venting system with a minimum hydraulic permeability of 1×10^{-3} cm/sec,
- Filter fabric to protect the venting system,
- Eighteen inch thick clay layer with a minimum permeability of 1×10^{-7} cm/sec,
- For areas with a slope of less than fifteen percent, a twelve inch thick drainage layer with a permeability of 1×10^{-3} cm/sec sand, and
- A thirty-six inch thick vegetative cover.

Reference Figure 4-2 for a drawing of the minimum liner and final cap design for a contained landfill.

CLOSURE AND CLOSURE CARE REQUIREMENTS

The owner is required to prepare a closure plan as part of the technical application, which describes all the necessary steps to close all units of the landfill and provide maintenance. This plan must identify:

- Methods, procedures, and processes to close each unit in accordance with the:
  - ✓ Environmental Performance Standards of 401 KAR 47:030,
  - ✓ Groundwater rules of 48:300, and
  - ✓ Closure regulations in:
    - o 48:070 section 15,
    - o 48:080 section 8 through 10, and
    - o 48:090 section 13.
- An estimate of the maximum open area or uncapped area for each landfill unit (or phase),
- A schedule for completing closure that includes beginning within thirty days following the final receipt of waste,
- The methods to maintain final cap, including necessary repairs due to erosion, settling, etc.,
- The maintenance and operation of the:
  - ✓ Leachate collection system,
  - ✓ Groundwater monitoring system, and
  - ✓ Explosive gas monitoring system.
- The name, address and telephone number of the contact person for the thirty year closure care period, and
- The description of the planned used of the property.

Following closure of a designated unit, the owner must submit a certification by a professional engineer that the phase has been closed in accordance with the approved plan. A copy of the approved closure plan must be kept onsite until the closure care period has ended. Once the Division has accepted the certification of closure, the owner must alter the deed to notify all potential purchasers of the location and time of operation, type of waste disposal, and caution against future disturbance of the area. Proof of this deed change is required before the Cabinet acceptance of the cap and release of the closure bond.

SPECIAL WASTE LANDFILLS

DESIGN REQUIREMENTS

Special waste landfills are designed and operated for the disposal of a specific type waste; thus, each design will vary. The regulations at 401 KAR 45:110 specify that the engineering design must be capable of meeting the EPS of 401 KAR 30:010 and the siting standards of 401 KAR 45:310 considering the following:

- Volume to be disposed,
- Climate of the area,
- Permeability of the liner material,
- Types of soil(s) underneath the facility,
- Hydrogeologic characteristics of the facility, including quality, quantity, current use and direction of groundwater flow,
- Proximity of the site to surface water and groundwater,
- Potential for gas emissions and odors,
- Design of the leachate, runoff and gas migration control systems relative to the specific waste to be disposed, climate and volume of leachate to be collected, and
- Characteristics of the waste, including how it will react when it comes in contact with the liner, cover materials and water. A good rule of thumb is to use clay for waste containing only metals and a composite liner (clay and synthetic) for wastes containing organics.

For coal combustion ash groundwater monitoring parameters, the applicant uses those specified in 401 KAR 45:160 section 8(2).

To determine groundwater monitoring parameters for wastes other than coal combustion ash, the applicant should:

- Do a waste analysis for those substances on the list in:
  - ✓ 40 CFR 264 Appendix IX (also 401 KAR 34:360),
  - ✓ 401 KAR 48:300 section 10 (the “big” list), or
  - ✓ the list of priority pollutants or similar list.
- List any chemicals at concentrations above the detection limit for use in characterization groundwater monitoring, and
- Chose several of the higher concentration organics and metals as “markers” for quarterly detection groundwater monitoring.

CLOSURE AND CLOSURE CARE REQUIREMENTS

As part of the technical application, the applicant is required to develop closure plans for the site to ensure compliance with the EPS. A special waste landfill closure plan must address:

- The type and amount of waste in the facility,
- Mobility and expected rates of migration of the waste and leachate,
- Site:
  - ✓ Location,
  - ✓ Topography,
  - ✓ Surrounding land use, and
  - ✓ Final site use.
- Climate,
- Characteristics of the cover material, such as:
  - ✓ Composition,
  - ✓ Erodibility,
  - ✓ Slope stability,
  - ✓ Surface contours,
  - ✓ Thickness,
  - ✓ Porosity,
  - ✓ Permeability,
  - ✓ Slope,
  - ✓ Length of run of slope, and
  - ✓ Type of vegetation to be used.
- Geologic profiles,
- Soil profiles,
- Surface water flow, and
- Subsurface hydrology.

This plan plus any other corrective work specified by the Division must be implemented according to the closure care schedule. The deed for the property has to be altered to notify future purchasers of the:

- Location of the waste disposal area,
- Time of operation of the facility,
- The nature of the waste, and
- Caution against future disturbance.

Once this work has been accomplished, the Division may accept the closure care certification prepared by the owner or his representative.

After the Division accepts the owner's closure certification, the facility must be maintained and monitored for a minimum of <u>five</u> years. This period is referred to as the post closure periods. Once two years has past, the Cabinet may release the bond equal to:

- The closure cost estimate, and
- Two years of post closure maintenance.

This means that the bond should still contain enough for the final three years of maintenance (see 401 KAR 45:110 section 5(6)).

Once the five year closure care period expires, the site must be inspected and records reviewed to determine the site's compliance with all regulatory requirements and that a ninety percent permanent vegetation cover exists. If the site is in compliance, the Division must release the closure bond within 180 days of its determination.

STUDY GUIDE
THE LANDFILL

1. A landfill is a solid waste disposal facility that is designed, operated and closed in a manner that complies with the ____________ ____________ ______________.

2. Environmental performance standards establish minimum standards to ensure that all solid waste sites or facilities:

   ____

   ____

3. Facility design considerations are based on:

   ____

   ____

   ____

   ____

   ____

   ____

4. The degree to which waste can be compacted is determined by

   ____

   ____

5. The degree of compaction directly affects the ______________ ___________ and the potential to increase _______________ production.

6. Kentucky regulations specify a compaction goal of __ pounds per cubic yard.

7. _________ _____ ______________ are a substantial part of the permit application, which is incorporated into the permit, by reference.

8. Describe the differences between specifications and plans.

SPECIFICATIONS

PLANS

9. Specifications include:

10. Plans are engineering drawings that show:

11. The six basic types of plan information necessary to show how a facility is to be developed are:

____

____

____

____

____

12. _________________________ plans show the entire site and its characteristics prior to any site development.

13. _________________________ plans show the entire site and its characteristics during and after site development, including the sequence of filling.

14. _________________________ plans are used to accurately calculate future or remaining waste disposal volumes.

15. A keen manager will stay at least _____ years ahead of major permit expansions to keep things flowing smoothly

16. ________________________ plans show the proposed final use of the site.

17. Plans for other information often include detailed information on:

____

____

____

____

18. All maps, plan sheets, drawings, isometrics, cross-sections, and aerial photographs submitted in the solid waste application must:

____

____

____

____

____

19. What are the six general siting requirements that must be considered for all solid waste landfills?

____

____

____

20. Landfills that will restrict the flow of the ______ year flood cannot be constructed.

21. The lowest component of the bottom liner of a landfill must be at least ______ feet above the seasonal high water table.

22. What are the four categories of fully permitted landfills.

____

____

____

23. Contained landfills meet Federal ________________ requirements for Municipal Solid Waste landfills.

24. There are different technical requirements for each of the four types of landfill. **True or False**

25. All solid waste landfills must include the following information on the technical application:

____

____

____

____

26. Residual landfills are designed and operated for the disposal of a ___________________________ and the design will vary.

27. After the Division accepts the owner's closure certification for a residual landfill, the facility must be maintained and monitored for a minimum of ______ years.

28. Design requirements for a construction/demolition/debris landfill provide for ________________ of surface water flow and leachate.

29. Construction/demolition/debris landfills must have a minimum __________ gallon leachate collection tank.

30. Construction/demolition/debris landfills must document coverage of _____ foot/feet of compacted cover at the end of the week; or, on lifts of 10,000 square feet.

31. A shelter for construction/demolition/debris landfill personnel must include: ______________________, ________________________, ________________, _________________, and _______________________.

32. The liner for a construction/demolition/debris landfill must cover the _________________ and __________________.

33. The final cap for a construction/demolition/debris landfill consists of (give inches and slope):

____

____

34. When the applicant restricts the waste to non-putrescible wastes and wastes that will not leach, the liner and cap may be modified to remove the __________.

35. A ______________ landfill may not be constructed within a 100-year floodplain.

36. For a contained landfill, sufficient equipment must be on site to compact wastes received within _______ hour(s) of receipt.

37. The design for a gas venting system in a contained landfill must have a minimum of ______ vent(s) per acre to be land filled.

38. Internal roads in a contained landfill must be all weather and designed within ______ feet of the working face.

39. A shelter for contained landfill personnel must include:

____

____

____

40. A contained landfill has a safety and communication plan which addresses:______________________ safe operation and maintenance to prevent accidents and breakdowns;_________________________ Description of:

____

____

41. The liner system for a contained landfill consists of a secondary and primary liner. List the components of each including the requisite number of inches where applicable:

Secondary Liner	Primary Liner

42. The final cap of a contained landfill must maintain a slope between _____ and _____ percent.

43. For a contained landfill, closure must begin within ______ days following final receipt of waste.

44. The final cap of a contained landfill consists of (give inches where applicable):

____

____

____

45. After the Division accepts the certificate of closure, the owner must alter the deed to notify all potential purchasers of:

____

____

____

CHAPTER 5
SOLID WASTE DECOMPOSTION AND ITS CHEMICAL BY-PRODUCTS

This section describes the decomposition of waste into landfill gas and leachate, differential settlement, its impact on the environment, methods of control and applicable regulations.

WASTE DECOMPOSITION

Wastes are decomposed both through chemical reactions with landfill liquids and the action of bacteria and other microbes that occur naturally in the environment. Organisms feed on organic materials found in garbage breaking them down into end products consisting primarily of:

- CO_2 (carbon dioxide),
- NH_4 (ammonia),
- CH_4 (methane),
- Humus, and
- H_2O.

The biological decomposition of solid waste follows three distinct phases:

PHASE 1:

The microorganisms slowly degrade the complex organic portions of the waste using the O_2 trapped during the landfilling process to form simpler organic compounds, CO_2 and water. This phase is termed aerobic decomposition.

PHASE 2:

After the CO_2 is fully consumed, bacteria grow and decompose waste into simpler molecules such as hydrogen, ammonia, CO_2 and organic acids. This second phase is step one of the anaerobic phase.

PHASE 3:

In the third decomposition phase (step two of anaerobic phase), CH_4 forming bacteria (methanotrops) utilize CO_2, hydrogen and inorganic acids to form CH_4 gas and other products.

Chemical reactions between wastes placed in landfills may also take place producing volatile constituents.

Complete decomposition may take fifty years or more. However, conditions are such that rapid decomposition occurs mainly within the first five years.

LANDFILL GAS

The gaseous end products produced in the most significant quantities are as follows.

CARBON DIOXIDE

- Is highly soluble in water, forms carbonic acid,
- Dissolves iron from metal cans and lime from materials containing calcium,
- Increases the hardness of water (including groundwater), and
- Is odorless and colorless.

METHANE

- Travels upward through fill or along the path of least resistance into the atmosphere, pipes or building,
- Not very soluble in water,
- Explosive, and
- Odorless, colorless and tasteless.

HYDROGEN SULFIDE

- Creates odors (rotten egg) and a foul taste when dissolved in water, and
- In the presence of dissolved oxygen in the water, sulfide will be oxidized to tasteless and odorless sulfur and sulfates.

ENVIRONMENTAL IMPACT

There are increasing concerns with the emissions of Landfill Gas (LFG) and its contribution to air pollution since volatile emissions from landfills represent a major source of organic contaminants entering the atmosphere. The concerns are based on the following:

- CH_4 gas is highly combustible, making it a potential hazard in the landfill environment, or in structures on adjacent properties,
- LFG is capable of migrating significant distances through soil, thereby increasing the risk of explosion and exposure. Serious accidents resulting in injury, loss of life and extensive property damage may occur where landfill conditions favor gas migration,
- As LFG is produced, the pressure gradient upward may create cracks and disrupt the geomembrane in the landfill cover,
- CH_4 gas is an asphyxiant to humans and animals in high concentrations. Migrating gas may result in other adverse effects such as stress to vegetation by lowering the O_2 content of soil gas available in the root zone,
- Gas generated at landfills and vented to the atmosphere frequently release nuisance odors causing annoyance to individuals residing nearby,
- Emissions of Non-Methane Organic Compounds (NMOC) and Reactive Organic Gases (ROG), contained in LFG, may be contributing to the degradation of local air quality. NMOC's include:
  - ✓ Benzene,
  - ✓ Toluene,
  - ✓ Ethyl benzene,
  - ✓ Vinyl chloride,
  - ✓ Dichloromethane,
  - ✓ Trichloroethylene,
  - ✓ 1,2,-cis Dichloroethylene, and
  - ✓ Tetrachloroethylene.
- Where landfills contain sources of sulfur, such as shredded construction/demolition material and gypsum board, there is increases potential for liberation of H_2S, which is noxious at low concentrations and can cause asphyxiation if gas is migrating to enclosed areas,
- Vinyl chloride from landfills has been found to be present in substantial concentrations in LFG's and has been detected in off site conduits, representing health and safety concerns. Vinyl chloride is found in municipal as well as commercial solid waste landfills,
- CH_4 gas, one of the "green house gases", contributes to the possibility of global warming of the earth's climate, and
- Uncontrolled LFG is a loss of potential resources. Instead it can be a satisfactory fuel for a wide variety of applications. Many types of energy equipment designed for conventional fuels can operate on LFG with the power output reduced about five to twenty percent.

LEACHATE GENERATION

In addition to the gases, landfills produce leachate. The amount of leachate generated is directly affected by the amount of water that is allowed to enter the fill.

Water can enter the fill through:

- Moisture and liquids contained in wastes,
- Poor surface water control,
- High water table, and
- Inadequate cover.

The entire landfill does not have to be saturated for leachate to be produced especially when water enters the fill from below.

Leachate usually contains elevated levels of:

Iron	Organic Carbon (TOC)
Chloride	Dissolved solids
Sodium	Phosphorous
Calcium	Nitrogen
Magnesium	Biological Oxygen Demand (BOD)
Sulfate	Acid
Metals	

Many studies indicate that leachate often contains Volatile Organic Compounds (VOCs). In 1988, EPA prepared a Congressional report on solid waste disposal. In this report, leachate studies from 70 municipal landfills were combined to characterize landfill leachate. The studies reported finding 82 chemicals in landfill leachate, including 63 types or organic chemicals. In the 70 landfill studies, concentrations of VOCs in leachate varied widely, but the researchers were able to calculate a median concentration for each chemical by averaging all of the data. Of the fourteen chemicals whose median concentrations exceeded federal drinking water standards, twelve are known or probable carcinogens and two are considered toxic to humans (see Table 1 for a list of common VOCs)[2].

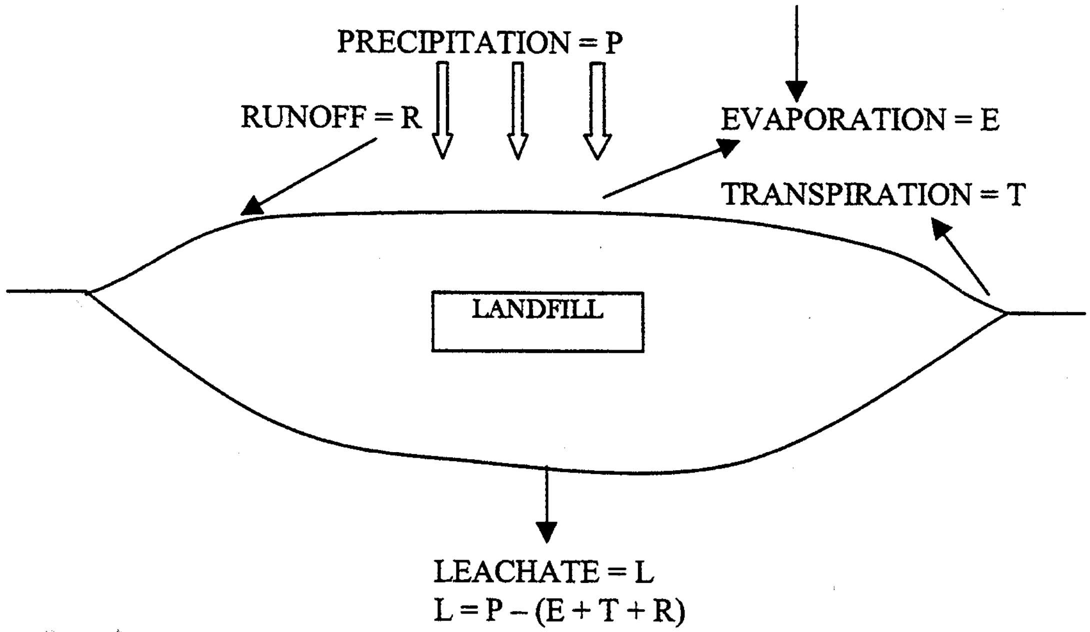
Therefore, the manager must ensure the proper pumping, hauling and treatment of landfill leachate in order to protect human health and the environment.

FIGURE 5-1

TABLE 1 Health Effects of Selected Volatile Organic Chemicals Found in Landfill Leachate	
Benzene	Human carcinogen, mutagen, and possible teratogen; central nervous system (CNS), peripheral nervous system, immunological and gastrointestinal effects; blood cell disorders; allergic sensitization; eye and skin irritation
Chloroform	Probable human carcinogen and possible teratogen; CNS and gastrointestinal effects; kidney and liver damage; embryotoxic; eye and skin irritation
1,1-dichlorethane	Embryotoxic; CNS effects; kidney and liver damage
Ethylbenzene	CNS effects; kidney and liver damage; upper respiratory system, eye and skin irritation
Methylene Chloride	Possible carcinogen; CNS, lung/respiratory system and cardiovascular effects; blood disorders; eye and skin irritation
Tetrachloroethylene	Probable carcinogen; CNS and lung/respiratory effects; embryotoxic; kidney and liver damage; upper respiratory tract and eye irritation
Toluene	Possible mutagen and carcinogen; CNS and cardiovascular effects; kidney and liver damage; upper respiratory tract, eye and skin irritation; and allergic sensitization
Trichloroethylene	Possible carcinogen and teratogen; CNS , kidneys, liver, cardiovascular system, and lung/respiratory system effects; blood cell disorders; skin, eye and upper respiratory irritation
1,1,1-trichloroethylene	Carcinogenic; mutagenic; CNS and lung/respiratory effects; kidney and liver damage; eye and skin irritation
Vinyl Chloride	Carcinogenic; mutagenic; possible teratogen; CNS effects; kidney and liver damage; blood cell disorders; skin irritation
Xylene	CNS and cardiovascular effects; kidney and liver damage; upper respiratory and eye irritation

SOURCE: Adapted from *The Poisoned Well* (Sierra Club Legal Defense Fund, 1989)

FIGURE 5-2

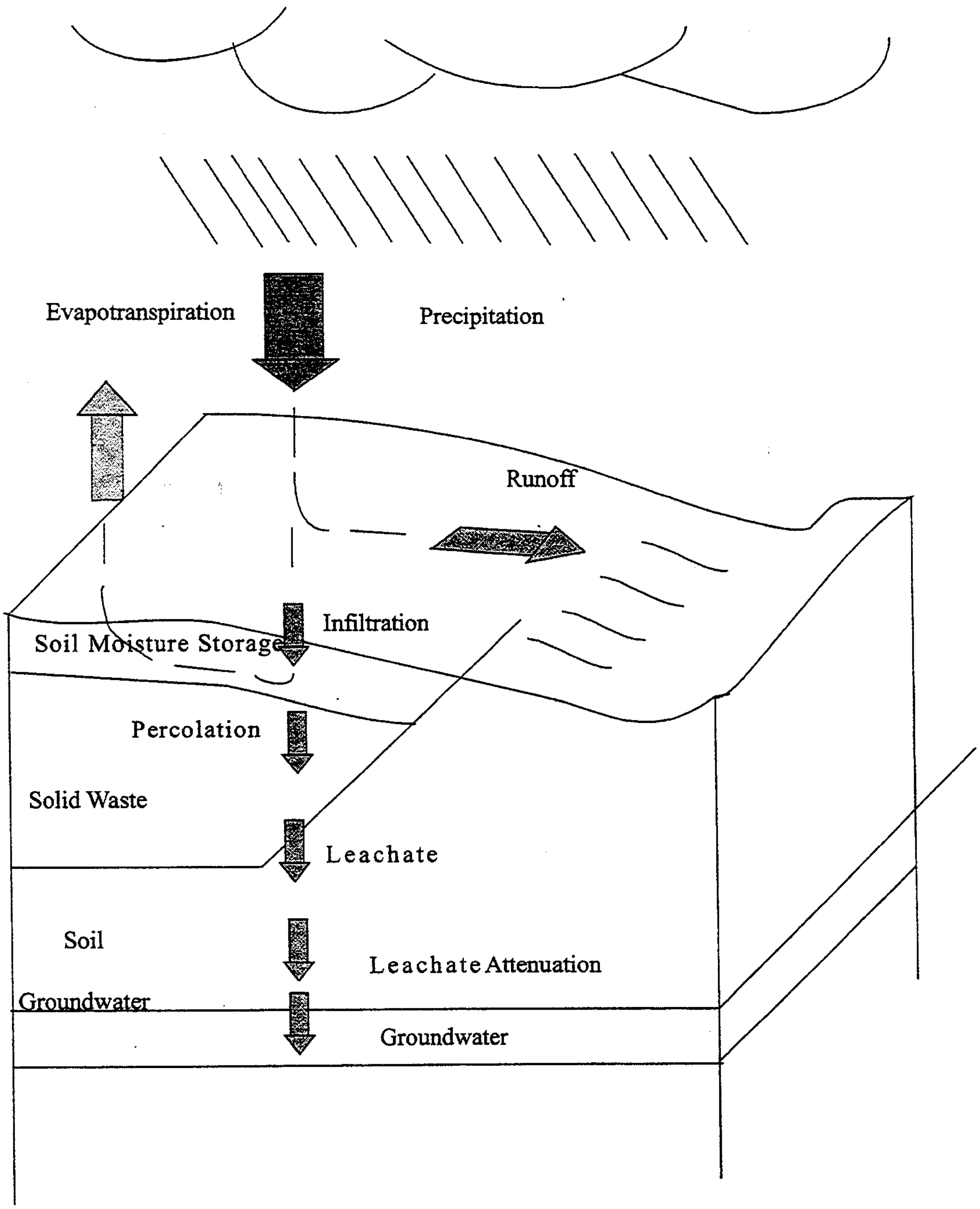


MOVEMENT OF GAS AND LEACHATE

Gas and leachate follow the path of least resistance and move more freely through permeable materials. Examples of highly permeable materials are sand and gravel, which are large grained and have enough air space between grains to allow water and gas to move easily. Clay and shale have low permeability and slow the passage of water. Several factors contribute to the effect that contaminants, found in leachate, may have on the environment:

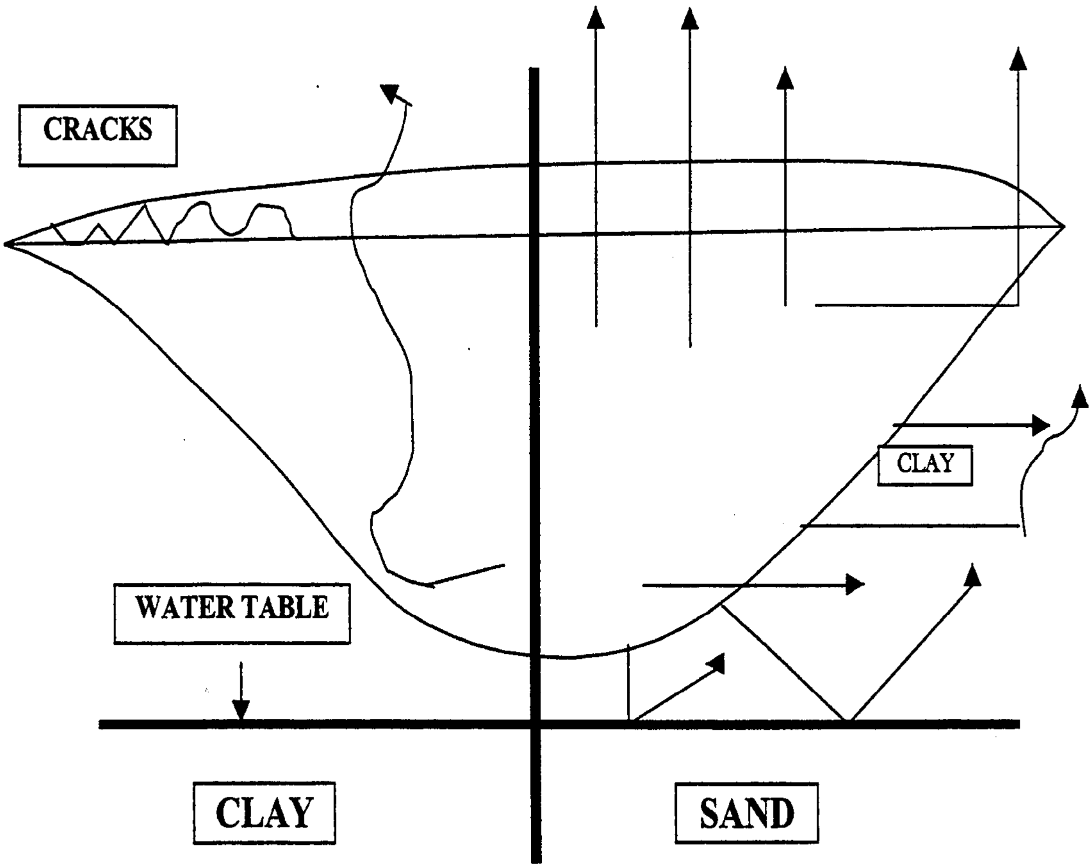
- Permeability of surrounding soils or the ability of soils to allow liquids to pass through,
- Layers of rock under the site,
- Ability of the soil and rock layers surrounding the site to physically filter or form a chemical bond with contaminants,
- Depth of water table,
- Direction and rate of groundwater flow, and
- Concentration of contaminants.

Figure 5-3



Evapotranspiration
Precipitation
Runoff
Infiltration
Soil Moisture Storage
Percolation
Solid Waste
Leachate
Soil
Leachate Attenuation
Groundwater
Groundwater

FIGURE 5-4



The presence of restrictive layers including frost, saturated soil, clay or synthetic caps will reduce vertical and potentially increase horizontal migration.

GAS CONTROL

Generally, there are two types of systems to control migration of landfill gas. These are active and passive systems.

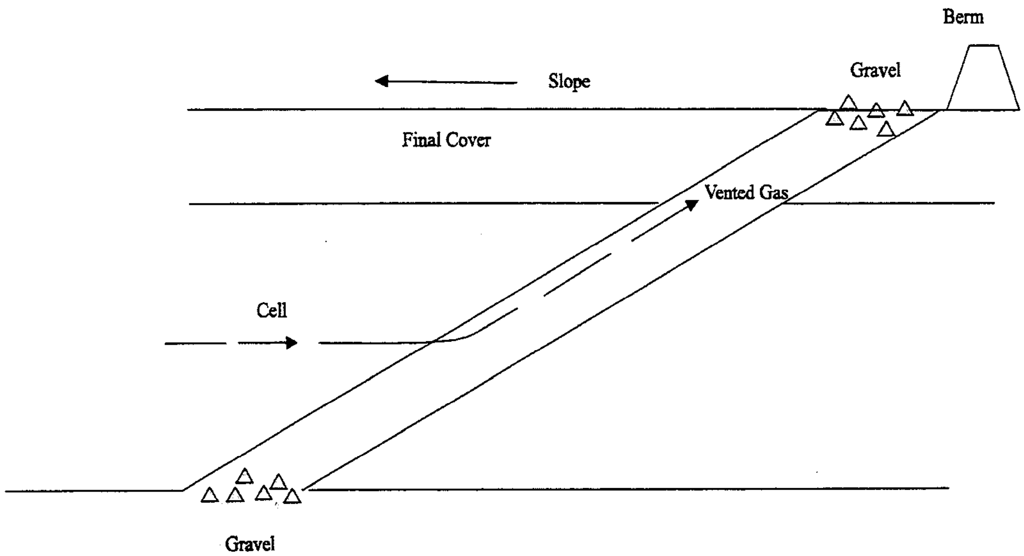
PASSIVE SYSTEMS

These are vents or barriers built into or adjacent to the fill that collect gas for release to the atmosphere.

ACTIVE SYSTEMS

These are a series of pipes connected to a blower to draw methane out of the landfill and collect it for flaring or energy use.

Figure 5-5
Passive Venting Systems



System for Residential, Residual, Special Waste and Non-Putrescible CDD Landfills

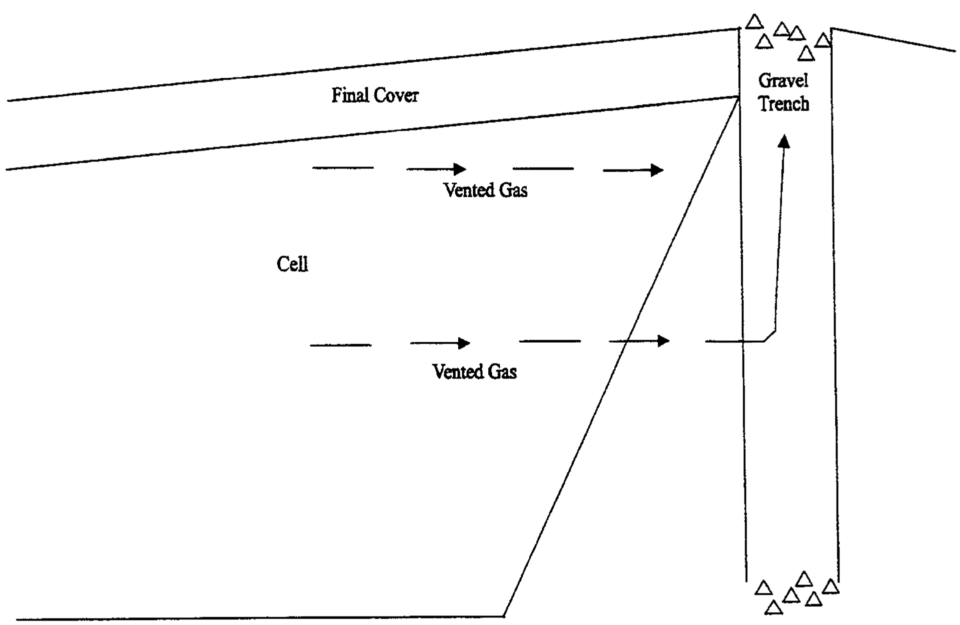


Figure 5-6
Gas Barrier Systems

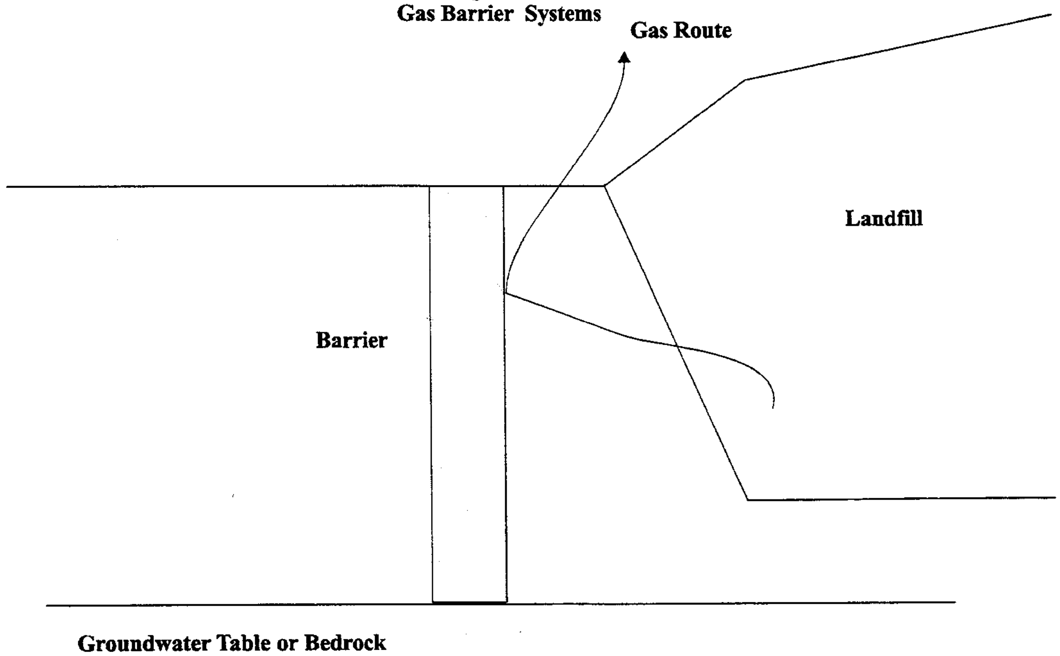
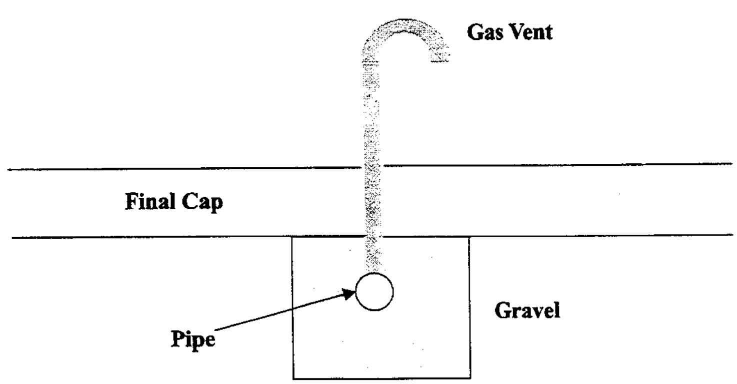


Figure 5-7
Passive Pipe Design



LEACHATE CONTROL

The most effective method of leachate control is to provide good drainage, high compaction of wastes and practice good surface water management. Newly developed contained landfills are required to install leachate collection systems. As discussed in Chapter 4, a composite liner consists of a leachate collection system. This system includes drainage provisions to promote runoff, pipes to provide collection of leachate flowing vertically and horizontally, and a tank for storage of the liquid collected until removal or treatment may occur.

Figure 5-8
Active Methane Control System

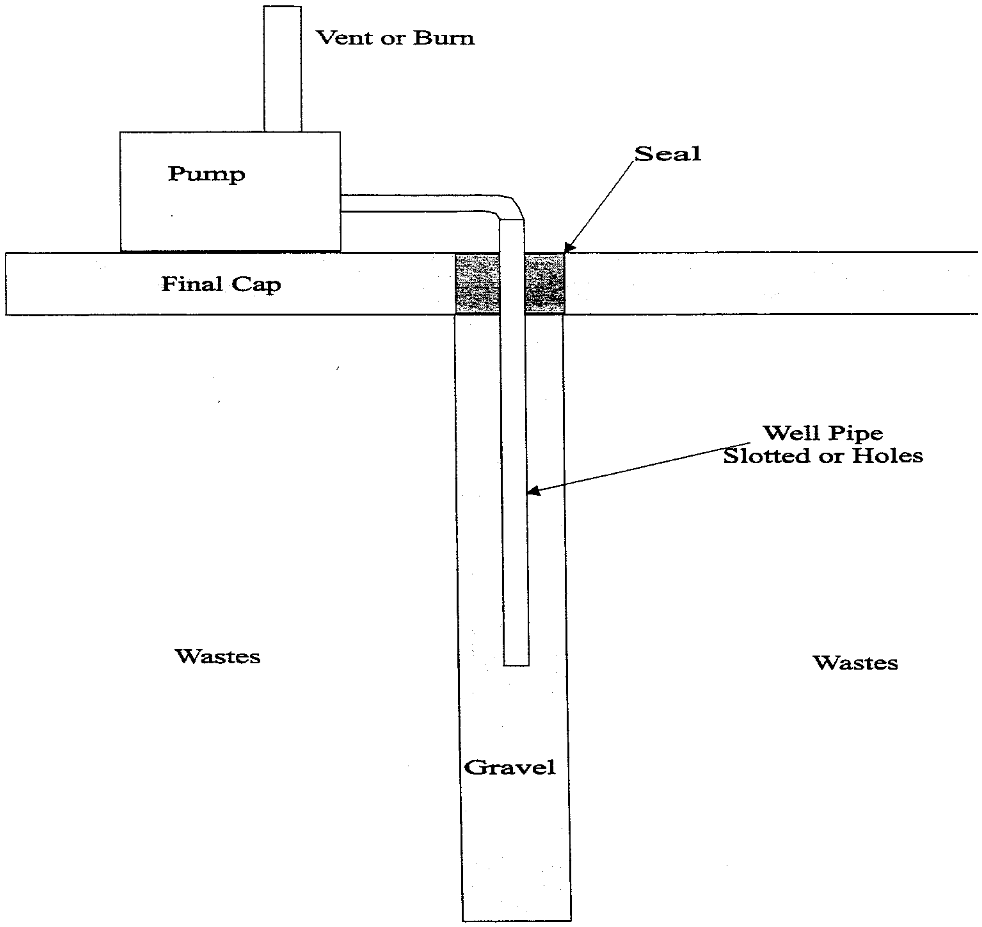


Figure 5-9a
Surface Water Control Methods

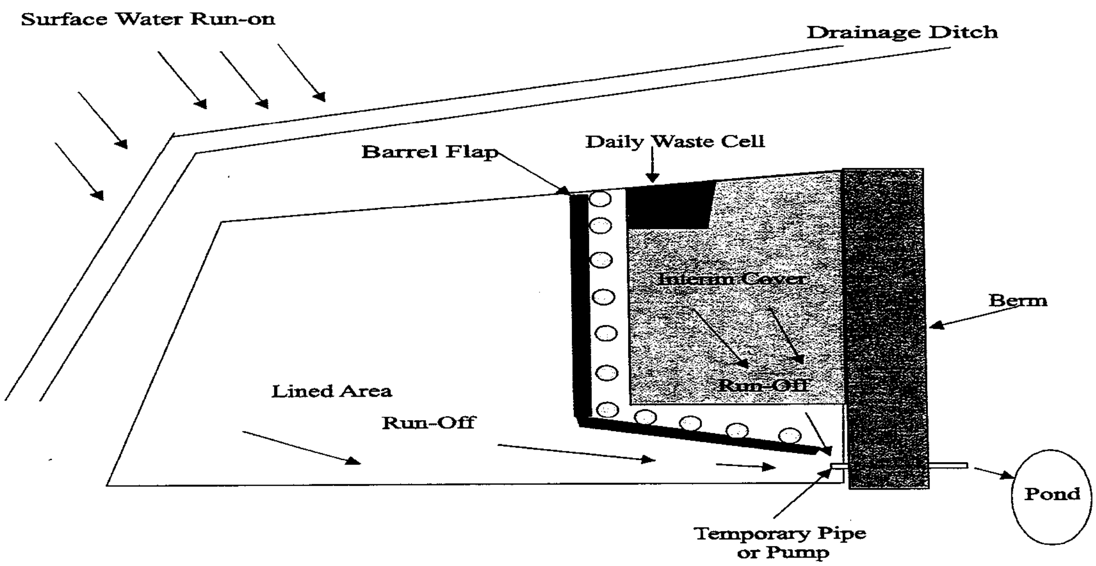
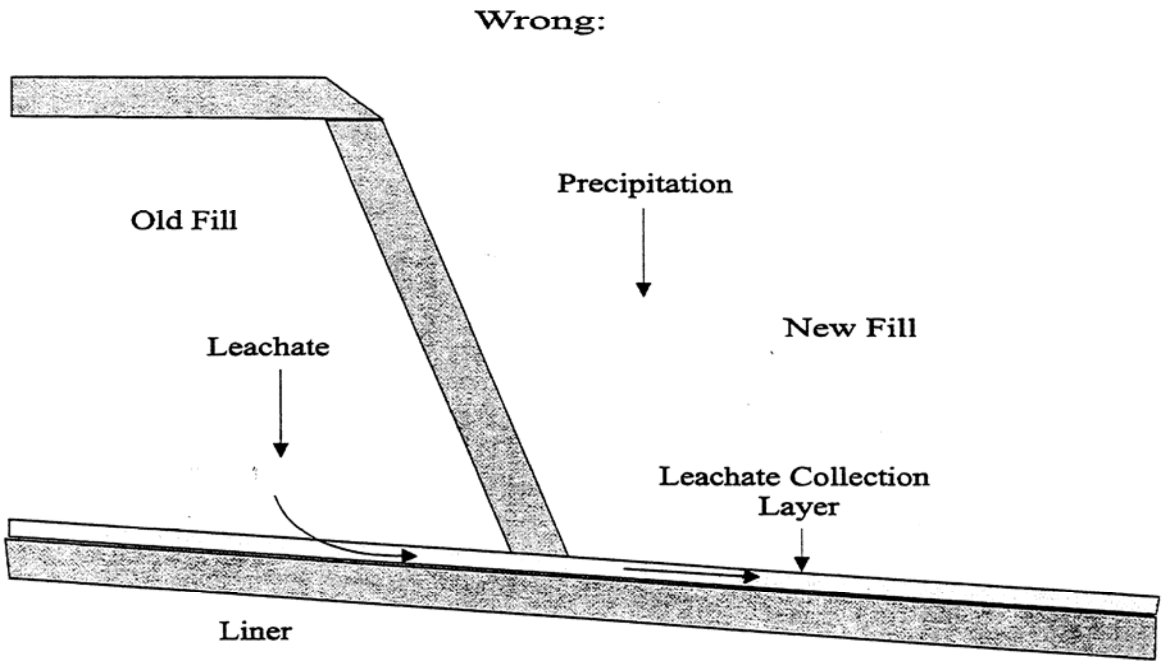


Figure 5-9b
Drainage Control Using Berms



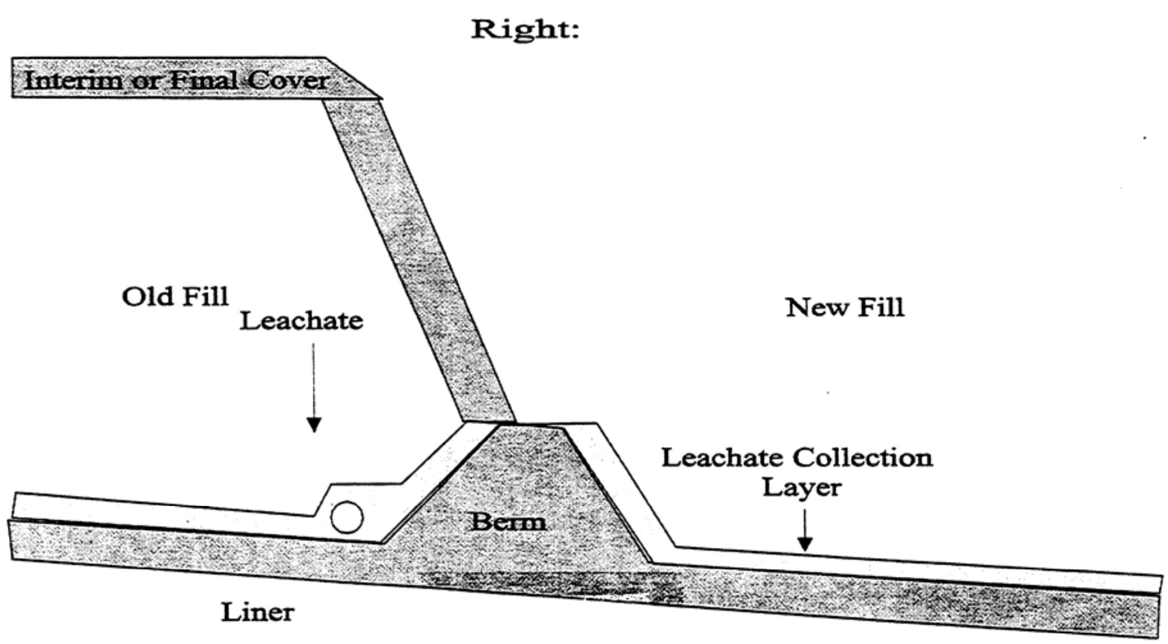


Figure 5-10
Landfill with Leachate Collection

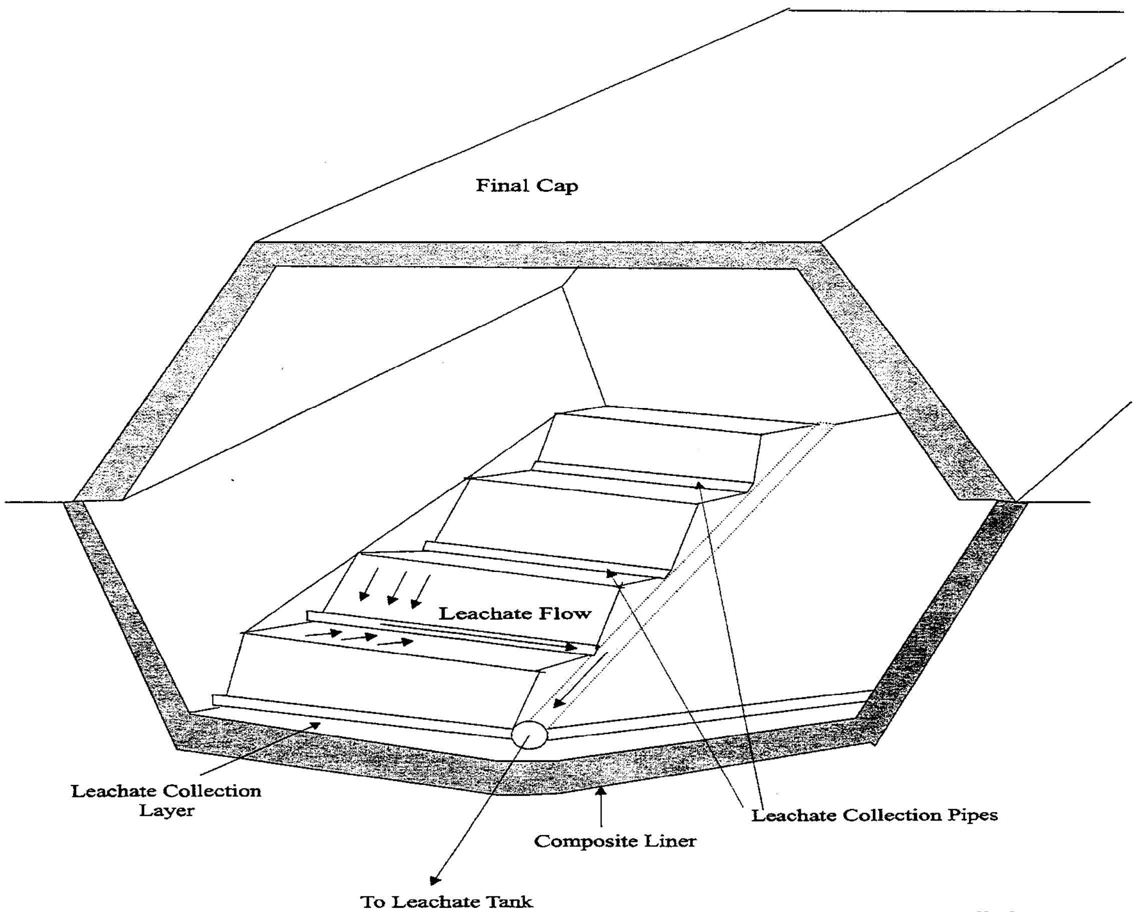


Figure 5-10 shows a cross section of a landfill with a leachate collection system installed.

LAND SETTLEMENT

The amount of settlement that will occur is dependent on several factors:

- Type of refuse,
- Depth of refuse,
- Amount of compaction,
- Rate of decomposition,
- Moisture content, and
- Loading.

There are two types of settlement – subsidence and differential.

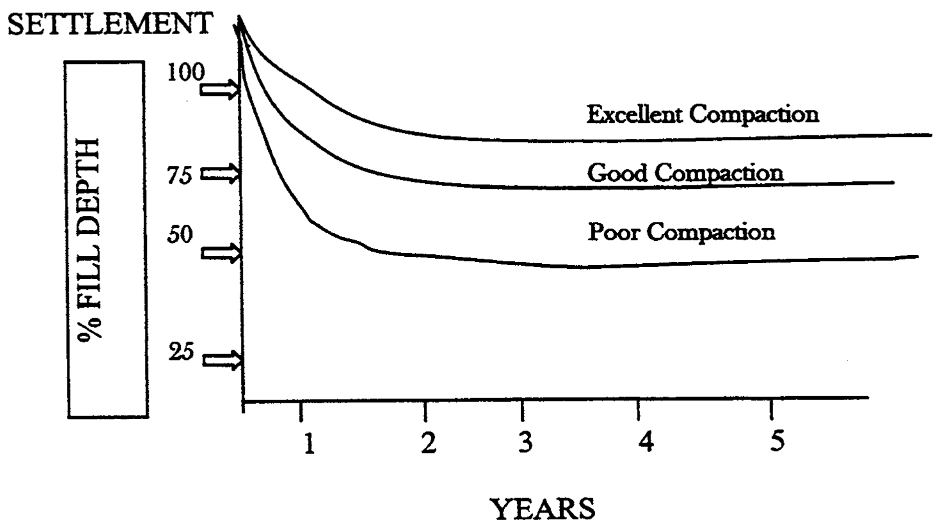
SUBSIDENCE SETTLEMENT

This is a uniform settlement or sinking of the entire fill that occurs slowly over time. Subsidence settlement is caused by:

- Weight of fill (related to height),
- Decomposition of waste resulting in less volume, and
- Poor compaction.

Control of settlement is accomplished by maximum compaction, final grade design and refilling settled areas. The following figure shows fill settlement over time based on compaction.

FIGURE 5-11



DIFFERENTIAL SETTLEMTENT

This is a non-uniform settlement of selective filled areas. These areas may be large or small in size and occur randomly throughout time.

Differential settlement is caused by:

- Traffic,
- Poor compaction,
- Highly organic waste placed next to inorganic or inert waste,
- Uneven filling, and
- Shifting of materials once decomposition occurs.

Problems created by differential settlement include:

- Allowing water to enter the fill through ponding,
- Increased leachate generation,
- Reduction of vegetative growth, and
- Restriction of the completed site use for surface and subsurface structures.

Damages to rigid structures not designed to withstand differential settlement are common and flexible pavements invariably fail when subjected to sub-grade settlement.

Control of Differential Settlement

To control differential settlement, the manager should:

- Buildup roadways with inert materials,
- Grade surface areas to promote runoff,
- Employ principles of good compaction that include:
  - ✓ 10:1 (no more than 4:1 slope) on working face with trash compactors,
  - ✓ 3:1 working slope for dozers on other types of waste,
  - ✓ 3 to 5 passes for maximum compactions,
  - ✓ spreading in maximum 2 foot thick layers, and
  - ✓ push waste up slope (at non-garbage sites).
- Separate bulky wastes,
- Compact inorganic waste tightly around bulky waste,
- Compact bulky wastes as much as possible prior to placing in fill,
- Keep working area smooth and uniform, and
- Fill depressions as they become evident and grade to promote runoff.

<u>Recognizing Settlement</u>

Settlement has occurred when any of the following conditions are noticeable:

Standing water	Ponding
Visible holes	Depressions
Cracks in cover	Flat slopes
Creation of high water lines	

GAS REGULATIONS

U.S. EPA

The United States Environmental Protection Agency (EPA) has issued regulations for control of air emissions from MSW landfills, based on section 111 the Clean Air Act (CAA). The federal government proposed the amendments to 40 CFR 60 by adding subparts CC and WW on May 30, 1991 at 56 FR 2448 and finalized them on March 12, 1996 at 60 FR 9918. The regulations require gas management systems as a component of the landfill final cover. Visit the following websites for more information:

- U.S. EPA Office of Air Quality Planning & Standards, Unified Air Toxics Website: Rule and Implementation Information for Standards of Performance for Municipal Solid Waste Landfills (Docket # A-88-09)

http://www.epa.gov/ttn/uatw/landfill/landflpg.html#RULE

- The LANDFILL GAS PAGE

http://www.mclink.it/personal/MD1337/home.htm

HOW IS A "NEW" LANDFILL DEFINED?

The New Source Performance Standards (NSPS) applies to "new" landfills. A "new" landfill is defined as a landfill that commenced construction, modification, or reconstruction on or after **May 30, 1991**. The Emission Guidelines (EG) applies to "existing" landfills. An existing landfill that commenced construction before May 30, 1991, but began accepting waste after May 1991 would be subject to the EG rather than the NSPS. If an existing landfill has been or is "modified" on or after May 30, 1991, it will be subject to the provisions of the NSPS. The definition of "modification" specific to landfills is included in the landfill NSPS (§ 60.751) and is based on the landfill's design capacity. A modification is an increase in the permitted design capacity caused by an increase in the constructed horizontal or vertical dimensions of the landfill. Each new landfill with a design capacity below **2.5 million megagrams (Mg) or 2.5 million cubic meters (m^3)** is exempt from most of the requirements in this rule. A small landfill with a capacity below the exemption level is required only to submit an Initial Design Capacity Report to the implementing agency (§ 60.752(a)).

HOW DOES NEW SOURCE REVIEW AFFECT LANDFILLS?

In addition to the NSPS, landfills may be subject to the **New Source Review (NSR)** requirements of the Act. The NSR program requires the preconstruction review of major new sources and major modification. The review includes a control technology review and an analysis of the air quality impacts of the new or modified source. New landfills that are major sources and existing landfills that make modifications that result in significant emissions increases are subject to major NSR requirements. For example, a landfill may install a combustion device to control NMOC, but simultaneously increase secondary emissions. However, there is an exemption of NSR that may be available to an existing landfill that would otherwise trigger NSR. This Pollution Control Project (PCP) exclusion was established to allow states to exempt from major NSR PCP's that are on balance "environmentally beneficial".

REGULATORY STANDARDS

The provisions of the NSPS apply to all "new" landfills with a maximum design capacity equal to or greater than **2.5 million Mg** and **2.5 million m^3**.

HOW IS THE NEED TO CONTROL LANDFILLS DETERMINED

Control requirements for a landfill are determined by calculating the NMOC emission rate from the landfill. The NMOC emission rate has been selected as a surrogate for LFG emissions. Each landfill that is at least **2.5 million Mg** and **2.5 million m^3** in design capacity must perform an initial NMOC emissions rate calculation until the landfill has installed a gas collection and control system according to specifications in the rule.

If the landfill NMOC emission rate is determined to be equal to or **greater than 50 Mg/yr**, the landfill owner or operator is required to **install a gas collection and control device** to reduce the landfill NMOC emissions [§ 60.752 (b)(2)]. If the landfill NMOC emission rate is determined to be **less than 50 Mg/yr**, then the landfill only needs to **calculate and report its NMOC emission rate** periodically. An NMOC Emission Rate Report is submitted each year until such time as the recalculated NMOC emission rate is equal to or greater than 50 Mg/yr or the landfill ceases to accept waste [§60.752(b)(1)]. These factors are described in greater detail in the background information document (BID) published at proposal and entitled "Air Emissions from Municipal Solid Waste Landfills – Background Information for Proposed Standards and Guidelines" (EPA-450/3-90-011a).

KENTUCKY REQUIREMENTS

The Kentucky Environmental and Public Protection Cabinet has several applicable rules for gas.

ENVIRONMENTAL PERFORMANCE STANDARDS

Air Pollution: No solid waste site or facility shall violate **applicable air pollution requirements** contained in KRS chapter 224 or 401 KAR chapters 50 through 63 (401 KAR 47:030 section 10(2) and 30:031 section 10(2)).

Safety for Explosive gases: No solid waste site or facility shall allow the concentration of explosive gases generated by the facility to exceed:

- Twenty-five percent of the lower explosive limit (LEL) for the gases in facility structures (excluding gas control or recovery system components), and
- The LEL for the gases at the facility property boundary (401 KAR 47:030 section 11 and 30:031 section 11).

LANDFILL RULES

Contained (Municipal Solid Waste) Landfill Rules:

- **Maintenance Equipment:** The owner or operator shall provide the landfill equipment required to maintain leachate and methane gas systems (401 KAR 48:070, section 6(3)(d)),
- **Buildings:** Each building shall have an alarm installed in accordance with the manufacturer's recommendations to detect the presence of explosive gases (401 KAR 48:070 section 9(3)),
- **Explosive Gas Program:** The application for a contained landfill unit shall include a quarterly methane monitoring program to ensure that the standards of Section 11 of 401 KAR 47:030 are met. The methane monitoring system shall be developed based on the following factors:
  - ✓ Soil transmissivity,
  - ✓ The hydrogeologic conditions surrounding the disposal site,
  - ✓ The hydraulic conditions surrounding the disposal site, and
  - ✓ The location of facility structures and property boundaries.
    - The minimum frequency of monitoring shall be quarterly.
    - A gas venting system shall be designed for all landfills. A minimum of one vent shall be required per acre of landfill to

be filled unless otherwise approved by the Cabinet (401 KAR 48:070 section 10; similar to 40 CFR 258.23).

- **Closure:** The operator of a contained solid waste landfill shall close each landfill unit and phase in a manner that minimizes the need for further maintenance and minimizes the closure care formation and release of leachate and explosive gases to air, groundwater, or surface water to the extent necessary to protect human health and the environment as required by 401 KAR 47:030 and 401 KAR 48:300 (401 KAR 48:070 section 15(1)),
- **Closure Cap:** At a minimum the final cap shall consist of a layered system. Each layer shall have the same slope of between five and twenty-five percent. The 995-control components, listed from bottom to top, are:
  - ✓ A filter fabric or other material approved by the Cabinet,
  - ✓ A twelve inch sand gas venting system with a minimum hydraulic permeability of 1×10^{-3}, and
  - ✓ A filter fabric or other material approved by the Cabinet (401 KAR 48:080 section 8(1) through (3)).
- **Alternative Specifications:** Alternative specifications may be used only after approval by the Cabinet upon a demonstration by a qualified registered professional engineer that they shall result in performance with regard to safety, stability and environmental protection equal to or better than that resulting from designs complying with the specifications of this administrative regulation (401 KAR 48:080 section 11).
- **Daily Cover Window:** The owner or operator may remove daily cover to facilitate the vertical passage of methane gas and leachate and shall recover the exposed areas within eight hours of exposure,
  - ✓ The owner or operator shall dispose of any daily cover removed under subsection (1)(d) of this section as solid waste.
- **Explosive Gases Control:** The owner or operator shall ensure that:
    - o The concentration of methane gas generated by the facility does not exceed twenty-five percent of the LEL for methane in facility structures (excluding gas control or recovery system components), and
    - o The concentration of methane gas does not exceed the LEL for methane at the facility property boundary.
  - ✓ The owner or operator of a contained landfill shall quarterly monitor for explosive gas at the following locations:
    - o Underneath or in the low area of each onsite building,
    - o At locations along the boundary as shown in the permit,

    - At each gas passive bent installed under the final closure cap,
    - At any potential gas problem areas, as revealed by dead vegetation or other indicators, and
    - At any other points required by the permit.
  - ✓ The owner or operator shall record the date, time, location, percent LEL and other pertinent information on the recordkeeping form approved by the Cabinet,
  - ✓ The owner or operator shall install, operate and maintain a gas detector with an alarm set at twenty-five percent of the LEL in each onsite building, and
  - ✓ If methane gas levels exceeding the limits specified in subsection (1) of this section are detected, the owner or operator shall:
    - Take all necessary steps to ensure immediate protection of human health,
    - Immediately notify the Cabinet of the methane gas levels detected and the immediate steps taken to protect human health, and
    - Within fourteen days, submit to the Cabinet for approval a remediation plan for the methane gas releases. The plan shall describe the nature and extent of the problem and the proposed remedy. The plan shall be implemented upon approval by the Cabinet (401 KAR 48:090 section 4 similar to 40 CFR 258.23(c) and 258.29).
- **Emission guidelines and compliance times:** Section 1, incorporated by reference: (1) 40 CFR 60.30c to 60.36c, **(40 CFR 60, subpart CC)**, Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills, as published in the Code of Federal Regulations (CFR), Title 40, Part 60, July 1, 1997, is incorporated by reference (401 KAR 61:036),
- **Risk-based limits for carcinogens** and other harmful elements (Air rule 401 KAR 63:020 and waste rule 401 KAR 47:120 section 2),
- **Title V major source** if one Hazardous Air Pollutant (HAP) exceeds 10 tpy, total HAPs 25 tpy, or any non-HAP 100 tpy. This would require a thirty day public notice (401 KAR 50:035 and 40 CFR 70).

<u>LEACHATE REGULATIONS</u>

RESIDUAL LANDFILL

The design of the facility leachate control system, runoff control system and gas migration control, if required, as it relates to the physical and chemical characteristics of the waste, the climatic conditions of the specific location, the volume of leachate and contaminated runoff collected at the facility (401 KAR 48:170 section 1(7)).

SPECIAL WASTE LANDFILLS

The design of the facility leachate control system, runoff control system and gas migration control, if required, as it related to the physical and chemical characteristics of the waste, the climatic conditions of the specific location, the volume of leachate and contaminated runoff collected at the facility (401 KAR 45:110 section 1(7)). **Note:** This is a best professional judgement call by the design team. For example: most coal combustion ash usually dos not have leachate collection, since it sets up and sheds water. However, one paper sludge landfill does have leachate collection, since it has a plastic liner on clay.

LESS THAN ONE ACRE C/D/D LANDFILL

The owner or operator of a less than one acre construction/demolition/debris landfill located inside a wellhead protection area, as defined in 401 KAR 5:002 section 1 shall construct and maintain a liner and leachate collection system (401 KAR 48:320 section 3):

- **The leachate collection system shall:**
    - Have a minimum of a twelve inch layer of grave, or a layer of equivalent material, and
    - Be discharged into a collection tank with a minimum capacity of 1,000 gallons.
  - ✓ A professional engineer licensed in Kentucky, pursuant to KRS 322.040, shall oversee the design and installation of the leachate collection system, and shall certify that the collection tank meets the capacity requirement. The certification shall be submitted to the Cabinet within ten days of completion of the liner (401 KAR 48:320 section 3(3) and (4)).
- **"Wellhead protection area" means:**
  - ✓ the surface and subsurface area surrounding a water well, well field or spring, supplying a public water system, through which pollutants are reasonably likely to move toward and reach the water well, well field or spring, or
  - ✓ an area defined as a wellhead protection area in a county water supply plan (401 KAR 5:002 section 1(323)). **Note:** there are about 100 Phase 1 wellhead protection plans approved. Contact the

Groundwater Branch for more information on wellhead protection areas at (502)564-3410.

GREATER THAN ONE ACRE C/D/D LANDFILLS

A construction/demolition/debris landfill shall be designed to keep surface water flows and leachate separate. The design shall include: surface contours to minimize surface water running onto or through the operational or completed fill area (401 KAR 48:060 section 1):

- the leachate collection tank shall be a minimum of 1,000 gallons. Additional capacity shall be provided to store leachate for a minimum of fifteen days production at peak production rates during operation and closure (401 KAR 48:060 section 1(2)(5)(d)). **Note:** The key is to do the weekly cover and direct storm flow off the top of the cover towards the sediment pond away from the Leachate Collection System (LCS). **The consulting engineer and site manager must talk to make this happen correctly.**
- The method of leachate disposal shall be described. When it is discharged to the sediment structure, a treatment plant is proposed or other method of discharge is proposed, the KPDES permit shall reflect this provision. When an off site wastewater treatment plant is used, the applicant shall provide written documentation showing the acceptance of the waste. The criteria for disposal at the wastewater treatment plant shall be stated. The LCS shall have a method to measure the quantity of leachate managed at the site (401 KAR 48:060 section 1(2)(5)(e)). **Note:** One site has modified its KPDES permit to discharge C/D/D leachate and storm water to a stream.

CONTAINED LANDFILLS

Owners or operators shall design landfills to ensure that: surface water flows and leachate are separated, surface contours minimize surface water running onto or through the operational or completed fill area (401 KAR 48:070 section 2).

- Leachate Storage Tanks: In addition to the requirements set forth in this administrative regulation, 401 KAR 47:180 and 401 KAR 47:190, an application for a permit to construct a contained landfill that includes a tank for leachate storage shall contain:
  - ✓ The estimated volume of leachate to be generated and a proposed system to record actual quantities stored and removed,

- ✓ A schedule of liquid removal,
  - ✓ A description of the final treatment and disposal of the liquid stored,
  - ✓ A description of the liquid storage facility design,
  - ✓ A method to measure the quantity of leachate extracted or removed and disposed,
  - ✓ A closure plan for the tanks, and
  - ✓ Design criteria to ensure that on-ground, in-ground, underground and above ground tanks are constructed of materials and installed, in such a manner, that the tank system shall contain the stored liquid for the active life of the site to include closure care. A procedure for periodic testing of the tank system shall be employed to assure the tank system does not leak (401 KAR 48:070 section 14).
- The leachate collection tank shall be a minimum of 1,000 gallons. Additional capacity shall be provided to store leachate for a minimum of fifteen days production at peak production rates during operation and closure (401 KAR 48:080 section 6(4)(f)). **Note:** The design engineer and site manager must strive to use the smallest practicable daily working face and area uncovered by one foot of soil interim cover. The fifteen days peak production is obtained from the HELP model, usually for the wettest fifteen day period over the last twenty years. The Cabinet is witnessing the actual production of leachate exceeding the model prediction because:
  - ✓ Large cells sit awaiting trash and water shedding daily and interim cover. The rainfall hits the plastic and flows into the LCS, and
  - ✓ Managers and operators are using larger operating areas than necessary.
- Garbage filling operations start in the worst possible place, where it is difficult, if not impossible, to redirect storm drainage. To correct this problem, managers should:
  - ✓ Talk to the engineer DURING the design phase (sequence of operations),
  - ✓ Talk to the operators and engineer and place interim drainage flaps, ditches and berms inside the current cell to divert storm water away from the working area and LCS, and
  - ✓ Limit the size of the constructed cell to one year of trash (construction mobilization cost is cheaper than leachate hauling and treatment costs).
- The method of leachate disposal shall be described. When it is discharged to the sediment structure, a treatment plant or other method of

discharge is proposed, the KPDES permit shall reflect this provision. When an off site wastewater treatment plant is used, the applicant shall provide written documentation showing the acceptance of the waste. The criteria for disposal at the wastewater treatment plant shall be stated. The LCS shall have a method to measure the quantity of leachate managed at the site (401 KAR 48:080 section 6(4)(g)). **Note:** Use the list of test parameters requested by the wastewater treatment plant as the landfill quarterly monitoring list.
- The leachate collection pipe system shall be designed to allow internal inspection, cleaning and maintenance (401 KAR 48:080 section 6(4)(h)). **Note:** This needs more emphasis. It is less expensive to clean pipe than replace it.
- Maintenance and operation of the leachate collection system in accordance with the requirements, if applicable, until leachate no longer is generated (401 KAR 48:090 section 13(1)(a)2). **Note:** This cost must be reflected in the closure care bond.

ALL SOLID WASTE LANDFILLS

LANDFILL RECORDKEEPING AND REPORTING

An applicant for a solid waste landfill permit shall submit plans for a recordkeeping and reporting system. The plan shall meet the following requirements:

- A quarterly report shall be submitted to the Cabinet on a form approved by the Cabinet no later than the 15th of the month following the end of each quarter year. The quarters shall end on March 31, June 30, September 30 and December 31 of each year. The report shall contain the following:
  - ✓ The quantity and concentration of leachate removed from the site, where disposed, and the method of disposal. The concentration shall be determined using appropriate parameters from section 10(2) of 401 KAR 48:300 for C/D/D landfills and section 10(3) of 401 KAR 48:300 for contained landfills (401 KAR 47:190 section 8(1)(e)).

BIOREACTORS

After years of designing "dry tomb" landfills, researchers are investigating the advantages and disadvantages of bioreactor landfills. These are operated to encourage, rather than prevent, the introduction of water into the wastes to speed microbial degradation, gas generation and settlement before final cap construction. Special permission from the Division of Waste Management is necessary for such a wet landfill, and must have a design that considers:

- The additional weight of the water in stability calculations,
- An active gas collection and flaring or energy system, and
- Additional safeguards against clogging the filter fabrics and soils in the leachate collection system from recirculation and greater loads.

The U.S. EPA requested information on bioreactors on April 6, 2000. See the enclosed Fact Sheet and Federal Register Notice.

1. p.A-1 to A-2, DEPARTMENT OF THE ARMY, U.S. Army Corps of Engineers, CEMP-RT, Engineering and Design, Technical Letter No. 110-1-160, 17 April 1995, LANDFILL OFF GAS COLLECTION AND TREATMENT SYSTEMS.

2. US EPA, EPA Report to Congress, Solid Waste Disposal in the United Stated, October 1998, EPA Office of Solid Waste and Emergency Response, EPA/530-SW-88-011B, Washington, D.C.

3. p. 1-3, Emission Estimation Procedures for State Plan Emissions Inventory, United Stated Office of Air Quality EPA-453R/96-004 Environmental Protection Planning and Standards, February 1999, Agency Research Triangle Park, NC 27711, Air Municipal Solid Waste Landfills, Volume 1: Summary of the Requirements for the New Source Performance Standards and Emission Guidelines for Municipal Solid Waste Landfills FINAL.

STUDY GUIDE
SOLID WASTE DECOMPOSITION AND ITS CHEMICAL BY-PRODUCTS

1. While complete decomposition can take fifty (50) years, rapid decomposition occurs mainly within the first ___ year(s).

2. How are wastes decomposed?

   Phase 1:

   ____

   ____

   ____

   Phase 2:

   ____

   ____

   ____

   Phase 3:

   ____

   ____

   ____

3. List the three (3) types of gas produced at landfills, in the most significant quantities, and features of each.

   a.______________________________

   ____

   ____

b.

____

____

____

c.

____

____

____

4. There are increasing concerns with the emissions of Landfill Gas (LFG) and its contribution to air pollution since volatile emissions from landfills represent a major source of organic contaminants entering the atmosphere. The concerns are based on the following:

CH4 gas is highly _________________; LFG is capable of migrating significant distances through soil, thereby Increasing the risk of ____________ **AND** ____________; As LFG is produced, the pressure gradient upward may create cracks and disrupt the _____________________________; CH4 gas is an asphyxiant to humans and animals in high concentrations. Migrating gas may result in other adverse effects such as ___________________Gas generated at landfills and vented to the atmosphere frequently release _________________ causing annoyance to individuals residing nearby; Emissions of Non-Methane Organic Compounds (NMOC) and Reactive Organic Gases (ROG), contained in LFG, may be contributing to the degradation of local __________________________; Where landfills contain sources of sulfur, such as shredded construction/demolition material and gypsum board, there is increased potential for liberation of __________, which is noxious at low concentrations and can cause asphyxiation, if gas is migrating to enclosed areas; Vinyl chloride from landfills has been found to be present in substantial concentrations in LFGs and has been detected in off-site conduits, representing ____________ **AND** ____________ concerns; CH4 gas, one of the "____________________", contributes to the possibility of global warming of the earth's climate; and Uncontrolled LFG is a loss of potential resources; instead, it can be a satisfactory _____________________ for a wide variety of applications.

5. What is leachate? .

____

____

6. Many studies indicate that leachate often contains Volatile Organic Compounds (VOCs), including:

____

____

____

7. The amount of leachate is directly affected by the amount of _______ allowed to enter the landfill.

8. Water can enter the landfill through:

____

____

____

9. _________ and ____________ follow the path of least resistance and move freely through permeable materials.

10. Examples of highly permeable materials are ______ **AND** ________, which are large, grained and have enough air space between grains to allow water and gas to move easily. _________ **AND** ________ have low permeability and slow the passage of water.

11. Several factors contribute to the effect that contaminants, found in leachate, may have on the environment: _____________ of surrounding soils or the ability of soils to allow liquids to pass through; Layers of ____ under the site; Ability of the soil and rock layers surrounding the site to Depth of water table; Direction and rate of ____________ ___________; and Concentration of ___________________.

12. Describe the two types of systems to control the migration of landfill gas:

a.____

____

____

____

b. ____

____

____

____

13. The three most effective methods of leachate control are:

____

____

____

14. Subsidence settlement is the __________ ____________ of entire fill that occurs slowly over time. It is caused by:

____

____

____

15. Control of subsidence is accomplished through:

16. Differential settlement, the non-uniform settlement of selective fill areas, is caused by:

17. To control differential settlement, the manager should:

18. Employ principals of good compaction that include:

19. List the noticeable conditions that indicate settlement has occurred:

____

____

____

20. Problems created by differential settlement include:

____

____

____

____

____

21. No solid waste site or facility shall exceed ____ percent of the Lower Explosive Limit for gases in the facility's structures.

22. Each building shall have a/an ________ installed in accordance with the manufacture's recommendation to detect the presence of ______.

23. If methane gas levels exceeding the limits specified in subsection (1) of this section are detected, the owner or operator shall:

____

____

____

24. A quarterly report shall be submitted to the cabinet, on a form approved by the cabinet, no later than the 15th of the month following the end of each quarter. This report must contain information on the _________ and ___________________ of leachate removed from the site, where the leachate was _____________ and the __________ of disposal.

25. The New Source Performance Standards (NSPS) applies to "new" landfills. A "new" landfill is defined as a landfill that commenced construction, modification, or reconstruction on or after ________________.

26. For Greater than One Acre Construction/Demolition Debris Landfills, The leachate collection tank shall be a minimum of ___ gallons. Additional capacity shall be provided to store leachate for a minimum of _____ production at peak production rates during operation and closure.

27. The __________________ landfill is generally defined as a landfill operated to transform and more quickly stabilize the readily and moderately decomposable organic constituents of the waste stream by purposeful control to enhance microbiological processes

CHAPTER 6
OPERATING YOUR LANDFILL

This section describes the operational requirements for contained, residual, special waste, and C/D/D landfills as well as the purpose behind these requirements.

Operating requirements for your landfill may be found in several locations. All landfills must comply with:

- Environmental Performance Standards,
- Regulations (401 KAR Chapter 47:030 and 401 KAR Chapter 30:031), both in the general requirements and the design and operational standards for the specific category of landfill (401 KAR Chapter 47 Solid Waste & 401 KAR 45 Special Waste); and
- Conditions listed in the construction/operating permit.

The owner, certified operators, and certified landfill managers are responsible for operating the landfill in compliance with all regulatory and permit requirements. A copy of the current permit must be displayed at the site and a copy of approved plans shall be reasonably available.

AT THE SCALEHOUSE

In order to determine whether your operational costs are acceptable, a common base of reference is needed. Without good records on the volume of waste disposed of at the landfill, you cannot determine cost per ton of waste. Volume data is also used to monitor the progress of filling and to project landfill space utilization.

The best data on waste volume is obtained by weighing the trucks at the landfill. This provides actual weights and records on how the waste stream varies. 401 KAR 48:070, Section 13 requires all contained landfills to install scales to measure the quantity of waste received daily. KRS 224.43 – 330 ( ) requires all MSW sites, including C/D/D landfills, to weigh wastes.

After the trucks are weighed, all data concerning waste volume, as well as the source of the waste from each truck, must be recorded. This information must be submitted as part of the quarterly report required by 401 KAR 47:190, Section 8.

The scalehouse operator must spot check all incoming loads for: unauthorized wastes (free liquids, etc.), and waste from unpermitted geographic sources.

TRAVELING TO THE WORKING FACE

SIGNS (401 KAR 48:090)

To prevent indiscriminate dumping, after working hours, landfills are required to have entrance signs posted at all public and waste hauling vehicle entrances. Information required for the sign includes landfill name, owner name, operator name, emergency phone number, and operating hours for acceptance of waste. C/D/D and contained landfills are also required to post the permit number and ensure that the sign is readable from a distance. Facility operators are required to abide by the operating hours posted on the entrance sign and have a certified operator available during these hours.

Warning signs must be posted at all access points of a contained landfill. These signs must be readable at a distance of 100 feet and should warn of site hazards (i.e., explosive gases, heavy equipment, and truck movements).

ACCESS (401 KAR 48:090 & 401 KAR 47:030, Section 11(3))

Owners and operators of >l Acre C/D/D and contained landfills must control public access and prevent unauthorized vehicular traffic. Both artificial and natural barriers may be used in conjunction with the following, which must be constructed <u>and</u> maintained at all times:

- Lockable entrance ways at all access points,
- Major access road from a publicly maintained highway to the landfill,
- Perimeter road, and
- All-weather road to within 200 feet of the working face.

The owner or operator is also responsible for removing all debris, mud and waste from vehicles <u>before</u> they leave the site. They are also responsible for removing any landfill debris, mud and waste from off site roadways.

Although not required by regulation, directing traffic helps prevent indiscriminate dumping away from the working face and helps prevent accidents. Traffic may be directed with barriers, signs, or a combination of both. Acceptable barriers include:

- Fencing,
- Logs,
- Telephone poles
- Rocks,
- Tires,
- Railroad ties.

ENTERING THE WORKING FACE AREA

UNLOADING

All waste unloaded at a contained landfill must be supervised by landfill personnel. This is required by 401 KAR 48:090, Section 9(9). The purpose of this is to:

- prevent accidents,
- prevent unauthorized scavenging,
- ensure detection of problem or unauthorized wastes; and
- prevent unloading at a rate that exceeds the capacity of on-site equipment used for compaction and cover placement.

Supervision also allows vehicles to be unloaded in specified areas. Since it takes more time for a vehicle to be unloaded manually, an improperly positioned vehicle could slow down the number of vehicles able to unload at a busy site or time.

Whether vehicles unload at the top or bottom of the working face will generally be determined by the design of the site. Dumping at the base of the operating face and pushing wastes up is preferred because:

- equipment can operate more efficiently and obtain maximum compaction rates,
- it is easier to control the size of the working face, and
- blowing litter is minimized.

RANDOM INSPECTIONS

401 KAR 48:090, Section 2 describes the procedures for excluding the receipt of hazardous waste. This section requires random inspections of incoming loads. The purpose of random inspections is to make sure that no hazardous waste enters the landfill with the exception of exempt hazardous waste that falls under 401 KAR 31:010, Sections 4(2)(a) and 5(7)(c)5. These inspections are also helpful in preventing disposal of unauthorized solid waste and free liquids.

While the Cabinet does not have any specific regulations outlining how random inspections should be conducted, the following must be taken into account:

- Random inspections should be documented and kept on file.
- Facility personnel must be trained in hazardous waste identification.
- Upon discovery of a hazardous waste, the owner or operator of a contained landfill must isolate the load and notify the Cabinet immediately.

SEPARATE WASTE HANDLING AREAS

401 KAR 48:070, Section 5 requires contained landfills to have specially designated handling areas, away for the working face, to handle certain wastes. Separate areas are required for:

- **Loads** containing burning or smoldering wastes,
- Wastes from pick-up trucks and automobiles, and
- Salvageable and recyclable materials - if the facility intends to manage these materials

Burning or smoldering waste could cause other wastes in the landfill to catch on fire. This creates a dangerous situation for landfill employees, people who are unloading and emergency personnel responding to the fire. It also causes air pollution. An area for these wastes must be designated on the permit.

Separate areas are required for pick-up trucks and automobiles simply because of safety reasons. It can be dangerous for smaller vehicles to unload at the working face because of heavy traffic from larger dump trucks and landfill equipment. An area for these wastes must be designated on the permit.

Because 401 KAR 48:090, Section 9(6) prohibits scavenging within 100 feet of the working face, incoming loads with salvageable and recyclable materials must be taken to an area separate from the working face. This area must be designated on the permit.

THE WORKING FACE

The exact size of the working face is not specified by regulation, however, contained landfills are required (401 KAR 48:090, Section 9) to confine dumping to the smallest practical area. Some permits may designate specific dimensions;

however, a general rule of thumb is to allow approximately 2 blade widths per piece of equipment operating. The size will be influenced by:

- quantity of waste received,
- number of pieces of equipment operating,
- approved plan, and
- Advantages of a small working face include:
  - ✓ minimizes exposure to wind and rain,
  - ✓ **less** cover material is needed at the end of the working day; and
  - ✓ lower equipment operating costs.

COMPACTION

Compaction is an extremely important factor in reducing many of the problems associated with landfill operation. Benefits include:

- less cover is used since large voids (or holes) in the garbage will be eliminated,
- air space is conserved, since more waste can be placed in a smaller area,
- amount of eventual settling in filled areas will be reduced,
- amount of blowing litter is reduced,
- runoff of surface waters is promoted; and
- creates a less permeable fill by reducing the amount of rainfall entering the landfill and reducing the potential for leachate (a liquid containing decomposed waste, bacteria, and other dangerous materials) generation.

Optimum compaction (i.e., maximum practical density) can be obtained through use of the following methods.

EQUIPMENT

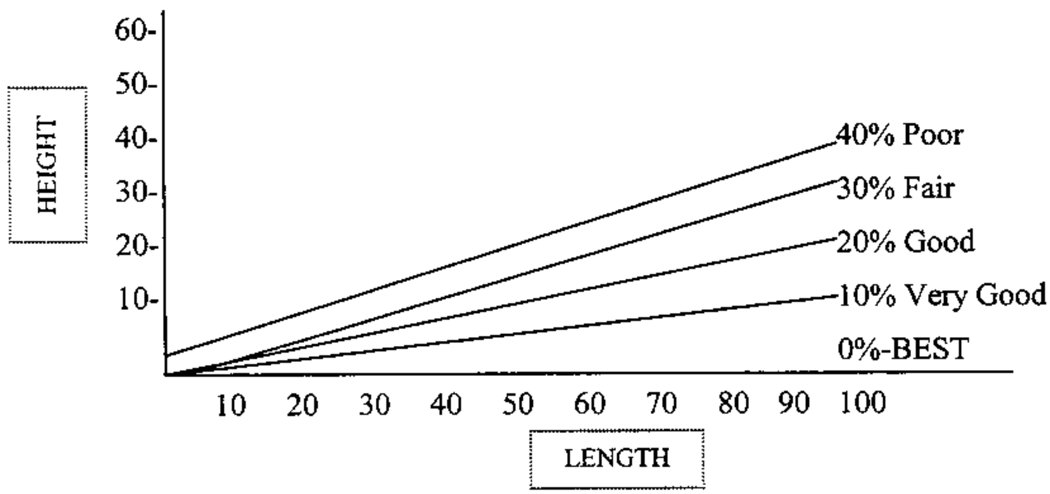
Use appropriate equipment for the type, size and volume of waste received and soil to be moved. For specific information on determining the type and size most suitable for your landfill, consult equipment dealers. Guidelines for selecting equipment can be found in the Equipment Section.

SLOPE

Track type equipment works more efficiently when wastes are pushed uphill on a 3:1 slope. This allows the weight of the equipment to be concentrated over a smaller track surface area. The design of a compactor allows the most efficient compaction to occur on flat ground since the weight is already concentrated over a small area. A comparison of the effects of slope on compaction with a compactor can be found in FIGURE 6-1.

FIGURE 6-1

SLOPE vs Compaction



SHALLOW LAYERS

Waste should be compacted in layers no more than 2 feet thick to reduce the effects of cushioning. As wastes are being pushed, lifting the dozer blade 2 to 3 feet off the ground can spread large piles of wastes. A lift height of 8 feet for construction/demolition/debris landfills or the height specified in the contained landfill permit must not be exceeded. A comparison of the effect of lift thickness on compaction density is shown in Figure 6.2.

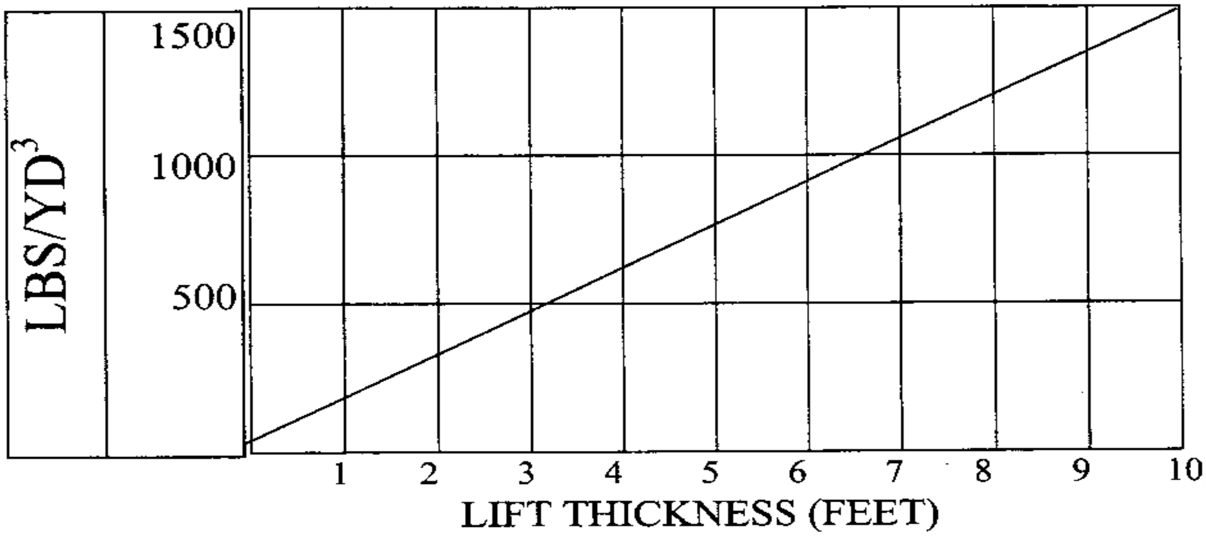


Figure 6.2 - Compacted Waste Density versus Lift Thickness

Passes - Optimum compaction is obtained by running over waste 3 to 5 times. You can see in FIGURE 6.3, less than 3 passes results in poor compaction. Densities do not increase after 5 passes. Operators of contained landfills are required to ensure that the entire waste surface is passed over 4 times. More information on equipment passes will be discussed in the Equipment Section.

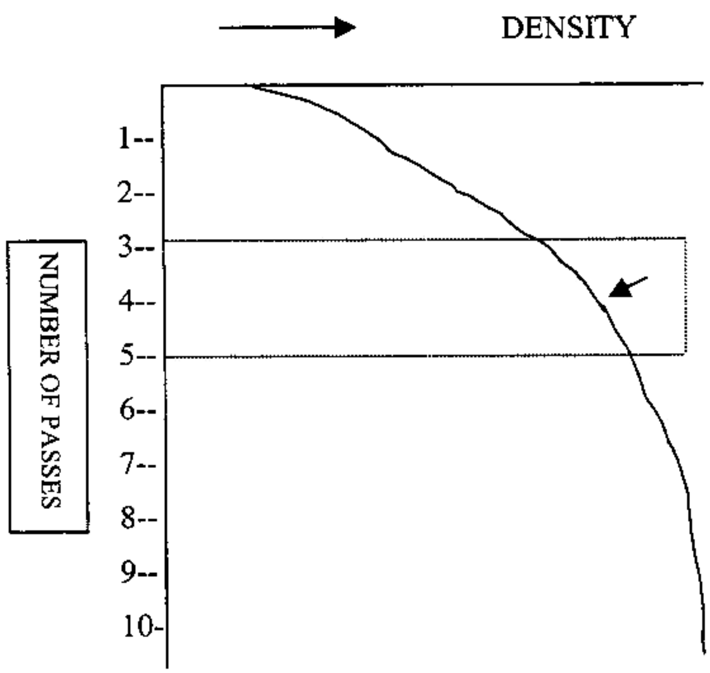


FIGURE 6-3

401 KAR 48:090, Section 9 requires contained landfills to have sufficient equipment available to spread and compact all waste within 2 hours of receipt. Waste should be spread in layers not exceeding 24 inches in depth. Contained landfills should strive for an in-place waste density of 1,200 pounds per cubic yard in a completed cell. Steel wheel compactors with a minimum gross ground pressure of 325 pounds per linear inch of wheel width, a gross weight of 30,000 pounds and 130 horsepower engine are suggested to accomplish this. Backup equipment must be available within 24 hours of breakdown.

COVER

Daily cover shall be placed over waste in each completed cell. 401 KAR 48:090, Section 3 requires daily cover to consist of 6 inches of soil, properly weathered or crushed shale, siltstone, or other materials pre-approved by the Cabinet. The purpose of this cover is to:

- Reduce vectors - Fly eggs cannot emerge through 6 inches of soil. This also reduces the attractiveness for rats and birds.
- Litter control - No waste is exposed after operating hours.
- Fire control - Glass left exposed to the sun can ignite other wastes. Daily cover also controls atmospheric oxygen and provides a fire barrier between cells.
- Reduce odors
- Promotes runoff - Reduces infiltration of surface water that produces leachate.
- Provides a medium for vegetative growth.
- Controls the movement of leachate and gases.

Daily cover shall not have any protruding waste, except for the occasional litter embedded in the surface. This protruding waste shall not exceed 10 percent of the cover area (401 KAR 48:090, Section 3).

Soils or other weathered/earthen materials that have been contaminated with petroleum may be used as daily cover if the maximum benzene concentration of the material is less than or equal to 1.0 ppm <u>and</u> the material is not placed as daily cover during a precipitation event.

Alternate daily cover can be used if approved by the Cabinet in advance. Different types of alternate daily cover include:

- Tarps (Belton),
- Posi-Shell

NOTE: Alternate daily cover may not be used unless the Cabinet has granted prior approval.

LITTER

Litter is a common problem at many contained landfills. Because waste is required to be covered on a daily basis (every 24 hours), there is a strong potential for waste to blow from the working face to other areas of the landfill. Litter can be controlled with litter fences or netting, but all litter attributable to the site's operation must be picked up within 48 hours per 401 KAR 48:090, Section 9. The area around the landfill must be policed on a regular basis to collect scattered material.

EQUIPMENT

The type and amount of equipment that a contained landfill is required to have depends on the amount of incoming waste. It is important to note that steel wheeled compactors must be used for compacting waste at the working face. Bulldozers may not be substituted. Also, backup equipment must be available for waste spreading and compaction, application of daily cover and maintenance of leachate collection systems within 24 hours of primary equipment breakdown. Specific types of equipment and their uses will be discussed in the Equipment Section.

SURFACE WATER CONTROL

Surface water control is an important factor in maintaining your landfill. If not controlled, excessive amounts of rainfall and other precipitation will soak into the fill and produce leachate. The following methods are used to control surface water:

Prevent runon - 401 KAR 48:070 states that, no surface water shall drain onto or through operational or completed fill areas of contained landfills. Surface water can be directed away from fill areas through the use of diversion ditches and berms. These structures must be shown on the engineering plans, and must be constructed.

Promote runoff - The entire site, including the area of the landfill being actively worked, shall be graded as necessary to drain rain water from the fill area and to prevent standing water. This is a requirement of 401 KAR 48:090, Section 7. Smoothly graded and crowned cover will allow water to runoff quicker and reduce the amount of water seeping into the fill.

Landfills are designed for surface water control based on the topography at a particular site. Therefore, it is important to use features (i.e., sediment structure, runon/runoff ditches, grading) as designated in approved plans for that site.

Uncontrolled surface water can also cause erosion. Operating requirements for contained landfills (401 KAR 48:090, Section 7) specify that the entire site be maintained as necessary to prevent erosion or washing of the fill. Discharge of sediment or fill material into the waters of the Commonwealth is prohibited under the Environmental Performance Standards in 401 KAR 47:030.

Methods used to control erosion include the following:

- vegetation - required for interim, long-term, and final cover,
- constructing permanent or temporary berms - recommended on steep slopes or slopes longer than 50 feet and may be constructed of earth or straw bales,
- constructing permanent or temporary diversion ditches, and/or
- operating equipment so track prints are perpendicular to the slope.

When erosion occurs, additional cover must be added and areas graded to maintain the required depth of cover.

LEACHATE CONTROL

Normally leachate can be controlled through the following good management practices:

- prohibiting the disposal of free liquids (401 KAR 48:060, Section 2(3), and 48:090, Section 8),
- maintaining a small working face and obtaining optimum compaction,
- using adequate cover on all areas,
- maintaining proper surface water control, and
- controlling erosion.

When leachate is observed, you should determine if the above practices are being followed. When problems are found, they should be corrected as soon as possible. The following may lead to production of leachate:

- moisture content of the waste - watch for liquid draining from trucks,
- a large working face and poor compaction,

- lack of adequate cover - use backhoe, dozer, or post hole digger to determine,
- poor grading or waste settling - check for standing water after rain,
- improperly functioning diversion ditches, and
- erosion ditches or gullies.

Small leachate outbreaks can sometimes be corrected by covering them with soil particularly if the source is identified and eliminated. However, if leachate cannot be controlled and is allowed to enter the waters of the Commonwealth, you will be operating in violation of the Clean Water Act.

At one time it was a common practice to build ponds to collect leachate. Ponds also collect large volumes of surface water and have the potential to overflow during heavy rains. Most collection systems are now designed for placement under fill areas, or along the toe of the fill, so that they are not exposed to surface water runoff. Leachate is then collected in tanks for disposal. Design requirements for leachate collection systems are discussed later in this manual.

To maintain a leachate collection system that will function, it is important to remember:

- geosynthetic filter fabric or other suitable material must be placed above the drainage layer to prevent clogging,
- proper construction of leachate lines is <u>extremely</u> critical in keeping the system draining properly and preventing clogging,
- pipes should have a minimum of 1 percent slope,
- the system should be designed to allow internal inspection, cleaning, and maintenance, and
- leachate must be pumped on a periodic basis to prevent overflow and clogging of collection lines.

Leachate may be disposed of by:

- discharging into sanitary sewers or wastewater treatment plant with <u>prior</u> approval,
- returning it to completed waste cells, if previously approved by the Cabinet, and
- properly treating it in a permitted onsite wastewater treatment plant.

The technical phase of the application includes a description of how leachate will be disposed of. The method of disposal selected must be utilized and proper approvals/permits obtained.

LANDFILL GAS CONTROL

When waste in the landfill decomposes, landfill gas can be generated. Wastes are decomposed both through chemical reactions with landfill liquids and the action of bacteria and other microbes that occur naturally in the environment. Organisms feed on organic materials found in garbage breaking them down into end products consisting primarily of:

$C0_2$ (carbon dioxide)	NH_3 (ammonia)
CH_4 (methane)	Humus
H_20 (water)	

Complete decomposition may take 50 years or more. However, conditions are such that rapid decomposition occurs mainly within the first 5 years.
Landfill gas is composed primarily of by-products of microbial reactions in the landfill. Initially, solid waste decomposes aerobically (with oxygen). The primary gas product is carbon dioxide. As the oxygen is used up, anaerobic (without oxygen) microorganisms become more active. These bacteria continue to produce carbon dioxide, but the process proceeds into second-stage anaerobic decomposition, where both methane and carbon dioxide are produced at approximately a 50 to 50 ratio. Other compounds are also produced by volatilization.

Landfill gases produced in the most significant quantities are:

- **Carbon dioxide,** which is highly soluble in water, forms carbonic acid, dissolves iron from metal cans and lime from materials containing calcium, increases the hardness of water (including groundwater) and is odorless and colorless.
- **Methane** is also produced. Methane travels upward through the waste or along the path of least resistance into the atmosphere, pipes, or buildings, and is not very soluble in water, explosive, odorless, colorless, and tasteless.
- **Hydrogen Sulfide** creates odors (rotten egg) and a foul taste when dissolved in water and in the presence of dissolved oxygen in the water; sulfide will be oxidized to tasteless and odorless sulfur and sulfates.

Because methane gas is so dangerous, landfills are required to monitor for its presence. Alarms must be installed in every building onsite to monitor for methane gas. 401 KAR 48:090, Section 4 requires the owner or operator to monitor for explosive gas quarterly at the following locations:

- underneath or in the low area of each onsite building,
- at locations along the boundary as shown in the permit,
- at each passive gas vent installed under the final closure cap,
- at any potential gas problem areas, as revealed by dead vegetation or other indicators, and
- at any other points required by the permit.

It is necessary to control gas production to prevent the gas from damaging vegetation and endangering human health. To control landfill gas, must install at least one of the following:

- passive gas vents, or
- gas recovery wells (flares).

More detailed information on these types of systems will be discussed in other sections of this manual.

POTENTIAL PROBLEMS ASSOCIATED WITH LANDFILL OPERATIONS

LITTER

Environmental Performance Standards found in 401 KAR 47:030, as well as landfill operating requirements, prohibit the grounds in and around the landfill from becoming a nuisance due to litter. Interior fences may be required to prevent litter from blowing from the landfill. The permitted area shall be policed on a routine basis to collect all scattered material. Litter can be controlled through the following practices:

- good compaction makes it more difficult for wind to scatter refuse,
- install litter fences placed downwind of the unloading area,
- require trucks to be covered,
- adequate placement of daily cover, and
- when practical, design and construct trenches perpendicular to prevailing winds.

FIRES

Environmental Performance Standards prohibit open burning of solid or hazardous wastes and/or violations of applicable air quality standards. While prohibited, fires do occur. Fires can be caused by:

- equipment fires,
- burning adjacent to fill areas,
- smoldering refuse, and
- glass wastes exposed to bright sunlight.

Prevent and control fires by:

- carrying fire extinguishers on all landfill equipment,
- do not bum near fill areas if this method must be used for land clearing,
- dump any smoldering wastes away from fill areas (401 KAR 48:060, Section 2(2), and 48:090, Section 5), and
- cover glass wastes immediately.

If a fire breaks out call the fire department immediately. To control the spread of an underground landfill fire, the area surrounding the fire should be saturated before applying water to the fire itself. Smoldering wastes should then be carefully excavated and completely cooled before they are returned to the fill.

A fire safety and response plan must be developed and maintained per 401 KAR 48:070, Section 12(4). The plan should include a topographic map showing the exact location of the landfill, a site map and an emergency contact, indicate the location of additional fire fighting water sources, all roads and major site features. Additionally, it should address how to reduce the risk of fire, identify all onsite equipment, and list the procedures to follow when responding to a fire. A copy of this should be delivered or mailed to the local fire department.

VECTORS

Insects or animals that carry disease-producing organisms are known as vectors. Common vectors include:

- flies
- rats
- birds
- mosquitoes
- dogs
- cats

Large flocks of birds attracted by a landfill can also create a hazard to aircraft. This is why new contained landfills are not be allowed to be sited within 5,000 feet of any airport runway used by piston-type aircraft or 10,000 feet of any airport used by turbo-jet aircraft. In certain cases, it is possible for the Cabinet and the Federal Aviation Administration to grant a variance.

Adequate cover, which eliminates both food and shelter, is normally adequate to control vectors. However, the Division may require other control measures when necessary. The local health department may be a useful source of information and assistance on vector controls.

INCLEMENT WEATHER

The following practices will help reduce the severity of problems associated with wet and extremely hot or cold working conditions.

- maintain at least a 3 day stockpile of cover material near the working face. More, if cover must be hauled a long distance,
- construct stock piles to promote runoff,
- drain surface water away from the working face,
- when needed, place a designated wet weather working area near the entrance and make sure adequate cover is readily available,
- construct all-weather roads,
- maintain a stockpile of gravel for use on roads,
- provide a heated equipment shed,
- maintain equipment in accordance with manufacturers recommendations, and
- on days that freeze and thaw, obtain cover early in the day before it has a chance to thaw.

DUST

Dust on haul roads and other areas of the landfill must be controlled to prevent a nuisance or violations of air quality standards. Water trucks may be used to reduce dust. However, used oil must not be used.

LAND SETTLEMENT

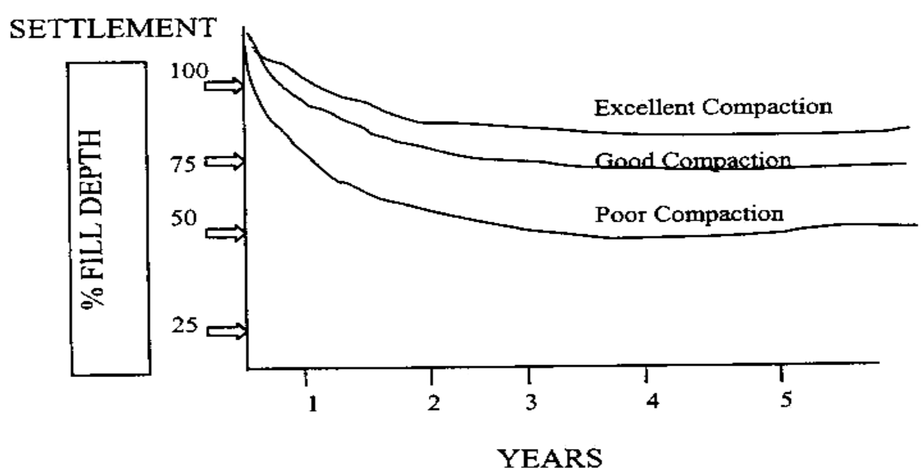
The amount of settlement that will occur is dependent on several factors:

- type of refuse,
- depth of refuse,
- amount of compaction,
- rate of decomposition, and
- moisture content.

There are 2 types of settlement - subsidence and differential. **Subsidence Settlement** is a uniform settlement or sinking of the entire fill that occurs slowly over time. Subsidence settlement is caused by:

- weight of fill (related to height),
- decomposition of waste resulting in less volume, and
- poor compaction.

Control of settlement is accomplished by maximum compaction, final grade design, and refilling settled areas. The following figure shows fill settlement over time based on compaction.



Differential Settlement is a non-uniform settlement of selective filled areas. These areas may be large or small in size and occur randomly throughout time. Differential settlement is caused by:

- traffic
- poor compaction,
- uneven filling
- highly organic waste placed next to inorganic or inert waste,
- shifting of materials once decomposition occurs.

Problems created by differential settlement include:

- allowing water to enter the fill through ponding,
- increased leachate generation,
- reduction of vegetative growth, and
- restriction of the completed site use for surface and subsurface structures

Damages to rigid structures not designed to withstand differential settlement are common, and flexible pavements invariably fail when subjected to sub-grade settlement. How do you control differential settlement?

- build roadways up with inert materials
- grade surface areas to promote runoff
- employ principles of good compaction that include:
  - ✓ 3:1 slope on working face
  - ✓ 3 to 5 passes for maximum compaction
  - ✓ spreading in maximum 2 foot layers
  - ✓ push C/D/D waste up slope
  - ✓ separate bulky wastes; compact inorganic waste tightly around bulky waste
  - ✓ compact bulky wastes as much as possible prior to placing in fill
  - ✓ keep working area smooth and uniform
  - ✓ fill depressions with clean fill (dirt) as they become evident and grade to promote runoff.

Settlement has occurred when any of the following conditions are noticeable:

- standing water
- visible holes
- cracks in cover
- creation of high water lines
- ponding
- depressions
- flat slopes

COVER REQUIREMENTS

Contained landfills are required to utilize 3 types of cover. The type utilized depends on the amount of time it will be used as a cover for wastes.

Daily cover - 401 KAR 48:090, Section 3(1), requires a compacted layer of at least 6 inches of soil to cover all exposed wastes at the end of each operating day; or for continuously operating landfills, once every 24 hours. Primary cover materials are soil, properly weathered or crushed shale or silt stone.

This cover must not allow waste to protrude except for occasional litter not exceeding 10 percent of the cover area. Daily cover must be placed and compacted to allow for proper drainage. The owner or operator may remove daily cover to allow methane gas to escape or for the removal of leachate. Any daily cover removed must be disposed of as a waste. Other daily cover requirements were discussed earlier in this section.

Interim cover - 401 KAR 48:090, Section 3(2) requires the placement of an additional 6 inches of cover material over an area not set to receive additional solid waste within 30 calendar days. Including the previously applied daily cover, this would result in a cover depth of 12 inches. Interim cover should be placed, compacted, and graded to allow proper drainage and should be protected by temporary erosion controls. Interim cover must be properly seeded during the fall seeding season.

Placement of interim cover normally means that the operator will utilize the area for disposal again in the near future. On the day waste is to be placed over an area that has interim cover, up to 6 inches of cover may be removed from the area of the cell for that days operation.

Long-term cover - 401 KAR 48:090, Section 3(3) requires the operator to apply an additional 18 inches of cover over all areas not scheduled to receive additional wastes within 4 months by September 15 of each year. This will increase the depth, including daily and interim cover, to a total of 30 inches. Long-term cover must be placed, compacted, and graded to allow for proper drainage. Erosion controls and proper seeding must be completed during the fall seeding season.

The entire 18 inches of long-term cover may be removed within 7 calendar days of placement of additional wastes. An additional 6 inches of cover may be removed on the day new waste is to be placed in the cell.

Final cap/cover - 401 KAR 48:090, Section 3(4) requires that final cover be applied within 30 days of filing a completed phase of the landfill to final design grade. Final cover consists of 36 inches of vegetative soil placed over the final cap.

The final cap must be in place by September 15 in all areas of the landfill which have reached final grade by August 15 unless otherwise approved. The final cap/cover consists of the following:

- cell graded to a final slope of more than 5 and less than 25 percent
- a filter fabric or other material approved by the Cabinet
- all inch sand gas venting system with a minimum hydraulic permeability of 1×10^{-3}
- a filter fabric or other material approved by the Cabinet
- an 18 inch clay layer with a maximum permeability of 1×10^{-7} centimeters per second
- for area of the final cap with a slope of less than 15 percent, a 12 inch drainage layer with a minimum permeability of 1×10^{-3} centimeters per second
- a 36 inch vegetative soil layer

Impermeable soils are required as a part of final cap/cover. However, it is difficult to establish vegetation on these soils, so we recommend topsoil be removed and stockpiled in a separate area and used as the top layer of final cover.

Contained landfills are required to record, on a form(s) approved by the Division, the daily cell locations, dates of all cover applications, and certification reports as required by 401 KAR 48:090, Section 3 (5).

> 1 ACRE C/D/D LANDFILL OPERATIONS

The operating requirements for construction demolition debris landfills are located in 401 KAR 48:060, Section 2. Many of the operational requirements for C/D/D landfills are similar to those of contained landfills.

The most important operational aspect is to operate in accordance with the approved plans and the permit. Any permit conditions must also be followed.

Construction/demolition/debris landfills are not required to have scales. However, the facility must propose, in the permit application, a method of collecting this data, as monthly waste volumes are required as part of the quarterly reports. All landfills are required to complete an annual survey between January 1 and May 1 of each year. This survey is to determine, through cross sections, the current waste placement and the remaining capacity in cubic yards.

As with contained landfills, C/D/D landfills must comply with the following operational requirements:

- a sign must be placed at the junction of the landfill access road and public road for the active life of the facility
- a sign must be posted at the entrance to the landfill showing the names of the owner and operator, an emergency telephone number, operating hours and permit number. Signs must be constructed of durable, weather resistant material. Letters and numbers should be a minimum of 3 inches tall
- unauthorized public access must be controlled
- all-weather roads must be constructed
- the operator must observe all loads during dumping and spreading
- Scavenging is prohibited. Salvaging and recycling will not be allowed without prior Cabinet approval
- no free liquids or hazardous wastes may be disposed of at the landfill
- maintain ditches and sediment basins
- prevent runon and runoff of surface water and prevent standing water
- no violations of Environmental Performance Standards (401 KAR 47:030)

COMPACTION AND COVER REQUIREMENTS

C/D/D waste must be spread and compacted in thin layers sufficient to minimize void spaces during placement of lifts. No lift shall be greater than 8 feet or the depth approved in the application.

Operating equipment must be on site during operating hours and capable of spreading and compacting the volume of waste received at the site. Backup equipment must be available within one week of primary equipment breakdown.

A 12 inch soil cover must be applied to all areas of exposed waste at least once a week.

Temporarily re-vegetate or otherwise protect against erosion all areas not set to receive additional refuse or final cover within 90 days.

Within 365 days of the last placement of waste in an area, final cover should be applied.

Final cover consists of the following:

- cell graded to a final slope of more than 5 and less than 25 percent,
- 12 inch cover layer overlain by 12 inches of 1×10^{-7} centimeters per second maximum permeability cap or its equivalent, (or 6 inches of $1 \text{ X } 10^{-7}$ with plastic liner)
- 6 inch drainage layer ($1 \text{ X } 10^{-2}$ cm/sec permeability, i.e., sand) if the slope is less than 15 percent) with field tiles, and
- 3 feet of vegetative soil.

RESIDUAL LANDFILL OPERATIONAL REQUIREMENTS

OPERATIONS

The operational requirements for residual landfills can be found in 401 KAR 48:170, Section 2. The regulatory requirements are not as detailed as those for contained landfills and C/D/D landfills.

Residual landfills are not required to have scales. However, the facility must propose in the permit application a method of collecting this data as monthly waste volumes are required as part of the quarterly reports. All landfills are required to complete an annual survey between January 1 and May 1 of each year. This survey is to determine, through cross sections, the current waste placement and the remaining capacity in cubic yards.

Residual landfills must comply with the following operational requirements:

- **a sign** must be placed at the landfill **entrance** containing the landfill name, names of the owner and operator, operating hours, permit number, contact person, and emergency telephone number, and
- operate in accordance with their approved plans and comply with any permit conditions.

COVER REQUIREMENTS

There are no specific cover requirements or timelines for residual landfills such as there are for contained landfills and C/D/D landfills, therefore, requirements vary from landfill to landfill. Cover requirements for each landfill are listed in their approved landfill applications or on their permit as permit conditions. In order to be in compliance, approved plans must be followed.

SPECIAL WASTE LANDFILL OPERATIONAL REQUIREMENTS

The operational requirements for special waste landfills can be found in 401 KAR 45:110, Section 3. As with residual landfills, special waste landfills do not have requirements as detailed as contained and C/D/D landfills.

Special waste landfills must comply with the following operational requirements:

- a sign must be placed at the landfill entrance containing the landfill name, names of the owner and operator, operating hours, permit number, contact person, and emergency telephone number,
- comply with the Environmental Performance Standards in 401 KAR 30:031, and
- operate in accordance with their approved plans and comply with any permit conditions.

COVER REQUIREMENTS

There are no specific cover requirements or timelines for special waste landfills such as there are for contained landfills and C/D/D landfills, therefore, requirements vary from landfill to landfill. Cover requirements for each landfill are listed in their approved landfill applications or on their permit as permit conditions. In order to be in compliance, approved plans must be followed.

STUDY GUIDE
OPERATING YOUR LANDFILL

1. A copy of the current ______ must be displayed at the site and a copy of the _________ _________ shall be reasonably available.

2. All ________________ landfills are required to have scales to measure the quantity of waste received ____________.

3. After trucks are weighed, all data concerning waste ____________ as well as the ____________ of waste from each truck must be recorded.

4. The scalehouse must ___________ check _______ incoming loads to check for unauthorized waste such as _______ _______ and _______________ ___________ as well as waste from unpermitted geographic sources.

5. Information on the entrance sign to a contained and construction/demolition/ debris landfill must contain what additional information not required on a residual landfill sign? ________ __________

6. Warning signs must be posted at all access points of the __________ landfill and be readable from __ feet and should warn of site hazards including: ________ ______, _______ ____________, and _________ _________.

7. List the access requirement for >1 Acre C/D/D and contained landfills.

____

____

____

____

8. List four reasons why all unloading of waste must be supervised at contained and construction/demolition/debris landfills:

____

____

____

____

9. In outlining how random inspections should be conducted, the following must be taken into account:

____

____

____

____

10. It is easier to control the size of the working face if dumping at **base/top** and pushed **upward**/**downward**. Circle correct answers.

11. Dumping waste at the base of the operating face and pushing waste up is preferred because:

____

____

____

____

12. Separate waste handling areas are required for:

13. A general rule of thumb is to have ___ dozer widths for a working face; advantages of a small face include:

14. The benefits of proper compaction include:

15. Track type equipment works more efficiently when wastes are pushed uphill on a __ slope.

16. The design of a compactor allows the most efficient compaction to occur on _______ ________ since the weight is already concentrated over a small area.

17. Wastes should be compacted in layers no more than __ thick to reduce the effects of “cushioning”.

18. Operators of container landfills are required to ensure that the entire waste surface is passed over __ times.

19. The purpose of cover in a landfill is to:

____

____

____

20. Alternative daily cover can be used if ___________ by the Cabinet in advance. Alternative daily cover includes: _________ and _____ _______.

21. Litter that is blown off-site of a contained landfill must be picked up within ___ hours.

22. ____________ must be used for compacting waste on the working face _____________ may not be substituted.

23. Backup equipment must be available for waste spreading and compaction, application of daily cover and maintenance of leachate collection systems within ___ hours of primary equipment breakdown.

24. Name two methods to control surface water:

____

____

25. List methods used to control erosion on the landfill site:

____

____

____

____

26. When erosion occurs, additional ___________ must be added and areas graded to maintain the ___________ of cover.

27. Good management practices in leachate control include:

28. Leachate may be disposed of by:

29. The following practices will help reduce the severity of problems associated with wet and extremely hot or cold working conditions.

30. List the different types of cover for contained landfills and the required depths for each:

31. The final cap must be in place by _______________ in all areas of the landfill, which have reached final grade by ________________ unless otherwise approved.

32. List reasons why an owner or operator would remove daily cover:

____

____

____

33. Daily cover removed must be disposed of as ____________.

34. The following concerns greater-than-one acre C/D/D landfills:
No lift shall be greater than ____or the depth approved in the application. Backup equipment must be available within ___ of primary equipment breakdown. A ______________ soil cover must be applied to all areas of exposed waste at least once a __________.

CHAPTER 7
LANDFILL EQUIPMENT

This section discusses operational considerations, describes the different types of equipments, the advantages and disadvantages for use in landfilling and equipment maintenance programs.

OPERATIONAL CONSIDERATIONS

Equipment is necessary for many different tasks at a landfill. Therefore, it may prove necessary to have more than one type of equipment available. Tasks to be considered when choosing equipment are:

HAULING OF COVER MATERIAL

- Volume required,
- Distance cover material transported, and
- Condition of the soil to be excavated.

WASTE AND SOIL COVER COMPACTION

- Type and amount of solid waste being compacted,
- Type and depth of cover material,
- Number of passes machine is required to make,
- Minimum weight and horsepower requirements, and
- Peak rates of waste disposal (tons per hour).

SUPPLEMENTAL TASKS

- Site clearing,
- Maintaining access road, and
- Excavating trenches.

MACHINE AVAILABILITY

- Recommended usage rates (capacity in units per hour),
- Backup equipment availability,
- Consideration of machine warranties when purchasing, and
- Estimated cost of machine repairs and labor for the life of the machine.

EQUIPMENT TYPES

DOZERS

Track-Type

Advantages

- Versatile in site preparation,
- Site finishing,
- Road building,
- Versatile in all weather conditions and soil types,
- Can move cover material up to 300 feet,
- Good stability – oscillating track frame,
- Can be used to pull scraper (hydraulic or cable), and
- Excellent digging and spreading capability.

Disadvantages

- Limited compaction,
- Limited off site use, and
- Limited resistance to abrasive materials.

Rubber Tire

Advantages

- Speed,
- Multi-purpose use, and
- Ability to provide off site use.

Disadvantages

- Limited traction,
- Tire hazard, and
- Poor stabilization in waste.

STEEL WHEELED COMPACTORS

Advantages

- Provides very good compaction of garbage waste and cover material,
- All weather operation,
- Resists abrasive material, and
- Offset lugs produce shredding action, which further compacts bulky items.

Disadvantages

- Limited ability to excavate and move cover,
- Lack of off site use, and
- Does not work efficiently with undisturbed earth.

FRONT-END LOADER

Track Type

Advantages

- Can transport cover material effectively up to 600 feet,
- Can load rock or cover material for transport,
- Excellent for excavating and carrying, and
- Versatile all weather machine.

Disadvantages

- Less stability than bulldozer – rigid track frame.

Rubber Tire

Advantages

- Special steel core tires offer some protection,
- Can be used for other jobs – snow removal, etc.,
- No special equipment needed to transport,
- Suitable for small landfills,
- Mobility for multi-site operations,
- Economical to haul cover material great distances, and
- Many attachments available.

Disadvantages

- Limitations – traction, tire hazards, stability, and
- Limited digging ability in tight soil.

Scrapers

Advantages

- Excellent for excavating, hauling and spreading cover,
- Self-propelled greater than 1,000 feet, and
- Good in all soil types.

Disadvantages

- Pull scrapers limited to 300 to 1,000 feet.

EQUIPMENT EXTRAS AND/OR MODIFICATIONS

Tracks

- Full height, single grouser pad design offers better traction and shredding action on bulky waste,
- Individual pads should remain overlapped or closed to reduce wire problem,
- Should be protected with full, heavy-duty track roller guards,
- If working in wet soil, extra wide tracks necessary for better flotation,
- Narrowest tracks are required for compaction, and
- Need heavy-duty guards for the front idlers and rear sprockets.

Bottom Portion of Equipment

- Needs heavy-duty bellyguard to protect motor and transmission from damage,
- Area should be smooth with minimum amount of obstruction, and
- Power operated bellyguards are available on some equipment.

Radiator

- Needs to be protected with extra heavy radiator guard,
- Needs combination forward flow or reverse radiator fan, and
- Auxiliary inside radiation screen is needed to restrict objects from entering the radiator core with fan in the reverse flow position.

Engine

- Needs louvered or screened side panels to protect motor and keep trash from entering engine compartment and radiator core.

Hydraulic System

- Parts of the system that have contact with solid waste need to be protected (reservoir, lines, cylinders), and
- If system is vented to outside, additional baffling may be necessary to prevent loss of fluid when operating on a steep incline.

Dozer Blade

- Hydraulically controlled preferred,
- Should be manufacturer’s standard landfill blade or have U-shape with trash guard on top, and

- Can push large volume of solid waste without taxing machine – dirt represent 2,500 to 4,000 lb/cu yd; loose solid waste averages 300 lb/cu yd.

Bucket

- Equipped with spill plate,
- Have bolt on replaceable bucket teeth,
- 4 to 1 bucket preferred (more versatile), and
- can adapt larger bucket to smaller machine so that width of bucket exceeds width of tractor – aids in pushing solid waste.

OPERATIONAL EQUIPMENT AVAILABLE

- roll over/falling object protective structures (ROPS/FOPS) offer safety protection for operator,
- rear-mounted cable controls or hydraulic hookups are necessary if you plan to pull a scraper with tractor,
- power winch and front pull hook are necessary when working in adverse soil or weather conditions that increase the possibility of equipment becoming stuck,
- locks to reduce vandalism,
- cap locks for fuel tanks and hydraulic reservoir,
- lock for battery compartment,
- instrument panel guard that can be locked,
- manufacturer's standard hour meter,
- fire extinguisher mounted in operator's compartment,
- heated/air conditioned cabs promote higher operator efficiency, and
- rippers on large dozers are useful in shale and thin limestone-shale formations for excavating.

It is particularly difficult to select equipment for a site where only one machine will be used. It must be capable of spreading and compacting solid waste and cover material, as well as having to excavate trenches or cover material.

The following chart gives characteristics of equipment performance in landfills.

TABLE 7-1

EQUIPMENT	SOLID WASTE SPREADING	SOLID WASTE COMPACTING	COVER MATERIAL EXCAVATING	COVER MATERIAL SPREADING	COVER MATERIAL COMPACTING	COVER MATERIAL HAULING
CRAWLER DOZER	E	F	E	E	F	N/A
CRAWLER LOADER	G	F	E	G	F	N/A
RUBBER-TIRED DOZER	G	G	F	G	G	N/A
RUBER-TIRED LOADER	G	G	F	G	G	N/A
LANDFILL COMPACTOR	E	E	P	G	G	N/A
SCRAPER	N/A	N/A	G	E	N/A	E
TRUCKS-OFF ROAD	N/A	N/A	N/A	N/A	N/A	E

*Basis of evaluation: Easily workable soil and cover material haul distance greater than 1,000 ft.
Rating Key: E = Excellent G = Good F = Fair P = Poor N/A = Not Applicable

MAINTENANCE

As discussed in the Operating Your Landfill Section of this manual, C/D/D and contained landfills are required to have sufficient equipment to spread and compact all wastes received. Backup equipment must be readily available too. These requirements make proper maintenance of equipment a "must" as it:

- maximizes equipment effectiveness and equipment life,
- minimizes equipment breakdown and excessive repairs,
- allows for reliable service to public,
- minimizes injuries from faulty equipment,
- helps maintain sanitary conditions at landfill, and
- minimizes sit downtime.

Contained landfills are required to have an equipment operating and maintenance recordkeeping program. This program must allow a landfill to track, at a minimum, availability of primary and backup equipment utilized for:

- spreading, covering and compacting waste,
- maintaining road and drainage features,
- dust suppression, and
- maintaining leachate and methane gas systems.

DAILY MAINTENANCE PROGRAM

- check safety and lock bars used during maintenance to ensure proper position,
- check radiator area for refuse blockages,
- check for worn hoses and cracked or loose fan belts,
- check hydraulic system for worn hoses or damaged lines,
- check covers and guards for damage and loose or missing bolts,
- check engine compartment for oil and fuel leaks,
- check the water trap in the bottom of the fuel tank and drain any accumulate water,
- close the air cylinder drain,
- check the rack for broken or missing shoes or bolts and waste accumulation, and
- check sprockets for wear.

RUBBER TIRE EQUIPMENT

- check the tire to vehicle clearance to prevent rubbing, and
- check ties for cuts, damage and proper inflation.

Pre-Mounting

- check all water, hydraulic fluid, oil and fuel levels,
- lubricate all moving parts per manufacturer's handbook,
- brush or blow out air pre-cleaner/radiators, clean engine compartment,
- check indicators and gauges for damage,
- check battery electrolyte level, and
- walk around the equipment once to ensure that everyone is clear of the equipment.

Operating

- observe equipment gauges,
- properly handle difficult and abrasive waste,
- clean machine of hanging or attached debris, and
- check for oil and fluid leaks.

Shutdown Procedure

- fill fuel tank to prevent condensation,
- before stopping engine, idle at 800 to 1,000 rpm for 3 to 5 minutes to let it cool off evenly and to allow turbochargers to slow down,

- don’t turn off the master switch with the engine running. If you do you can seriously damage parts of the electrical charging circuit.
- If no shelter facilities are provided, park away from potential fire hazards, preferably on a level grade to prevent roll-away. This will prevent oil leakage from roller seals on crawler equipment. Park the equipment on top of some type of barrier to prevent freezing to the ground.
- Lower to the ground all blades, buckets, scrapers or other movable parts. Release all pressures to prevent accidents.
- Set brakes and transmission lock.
- Remove all debris, wire, trash, mud, etc. from equipment daily.
- Open equipment guards and remove trash and paper daily.
- Report the condition of equipment at the end of each shift or work period and complete equipment log sheets.

PERIODICAL MAINTENANCE PROGRAM – EXAMPLE PROGRAM

Every 125 Hours:
- Change engine oil and filters,
- Change starting engine oil,
- Grease radiator fan and fan idler pulley, and
- Clean main air cleaner.

Every 250 Hours:
- Change oil in master clutch,
- Change transmission filters,
- Clean transmission magnetic filter, and
- Change fuel filters.

Every 500 Hours:
- Grease main U joint.

Every 1000 Hours:
- Change oil and filter in final drive, and
- Change hydraulic oil and hydraulic oil filters.

PREVENTIVE MAINTENANCE

The equipment manufacturer has recommended schedule for preventive maintenance services. Follow this recommended schedule for each machine.

- Individual equipment maintenance logs should be maintained.
- Scheduled oil sampling will allow repairs before major destruction of a large component occurs.
- Have fuel supplier submit sulfur content of each fuel delivery. Fuel sulfur content over one half percent requires special maintenance procedures.

OTHER EQUIPMENT USED AT LANDFILLS

Motor
- Construction and maintenance of roadways, drainage, and final grades.

Hydraulic Excavators
- Loading trucks, drainage work, cleaning of sediment ponds and handling baled waste.

Backhoe/Loaders
- Excavating leachate trenches, cleaning frozen roll-off boxes and other miscellaneous needs.

Soil Stabilizers
- Large rotary hoe type machine is useful in conditioning soils for liners.

Soil Compactors
- Heavy (44,000 pounds) equipment is needed for construction of soil liners. Non-vibratory types are required by 401 KAR 47:190 section 6(2)(a).

EQUIPMENT REGULATIONS

CONSTRUCTION/DEMOLITION/DEBRIS LANDFILLS

- All compaction equipment to be used for site operation shall have a minimum weight of 30,000 lbs and a minimum 130 horsepower motor. Sufficient equipment shall be listed on the application to handle the cover requirements in subsection (3) of this section as well as working cell grading and compaction (401 KAR chapter 48:060 section 1(5)). **Note:** This is equal to a D-6 or its equivalent.
- Adequate soil material shall be available to provide one foot of compacted cover on lifts of every 10,000 square feet, at the end of each working week, or at intervals sufficient to reduce fire hazards, prevent an

unsightly appearance, and eliminate disease vectors (401 KAR 48:060 section 1(3)). **Note:** Alternate daily cover material may be used with the Cabinet's permission. This would normally be a material that sheds water while resisting poking by boards and pipes.

- Operating equipment shall be onsite during operating hours and capable of spreading and compacting the volume of waste received at the site. Backup equipment shall be available within one week of primary equipment breakdown (401 KAR 48:060 section 2(12)). **Note:** Rental equipment is acceptable.
- Before earth-moving equipment is removed from the site, an inspection of the entire site shall be made by an authorized representative of the Cabinet to determine compliance with approved plans and specifications. The owner or operator shall present the quality control records demonstrating compliance with the permit (401 KAR 48:060 section 3(1)(e)). **Note:** This intent is to save you moving costs. If you must regrade the cap, you must bring back the equipment.

CONTAINED LANDFILLS

- Sufficient equipment shall be available to spread and compact all wastes within two hours of receipt. **Note:** Review your waste records and consult the equipment handbook.
- Steel wheeled compactors, designed for landfill operation, shall be specified for residential, and solid waste compaction.
- The owner or operator shall provide the landfill equipment required to:
    - ✓ Handle all daily, interim, long term and final cover requirements,
    - ✓ Maintain all roads and drainage features,
    - ✓ Provide dust suppression,
    - ✓ Maintain leachate and methane gas systems, and
    - ✓ Properly compact waste at peak receipt rates. These rates shall be determined in tons per hour and kept on file with the Cabinet.
- Backup equipment shall be available for waste spreading and compaction, application of daily cover and maintenance of leachate systems within twenty-four hours of primary equipment incapacitation. **Note:** Rental equipment is acceptable, but owned equipment is preferable.
- Landfill compactors shall have a minimum gross ground pressure of 325 lbs per linear inch of wheel width. **Note:** There have been problems with this specification apparently pointing to one brand. The Cabinet will grant a variance to use another brand if the 1,200 lbs/cu yd density goal is achieved.

- Any equipment used for compaction shall have a minimum gross weight of 30,000 lbs and a minimum of 130 engine horsepower.
- The primary working face equipment used for waste spreading and compaction shall have the standard landfill guard package offered by the manufacturer, or an otherwise reasonable adaptation, to provide protection from waste damage hazards and other landfill operating hazards.
- The operator shall propose an equipment operating and maintenance recordkeeping system. The system shall, at a minimum, track the availability of each piece of equipment in subsection (1) and (4) of this section.
- Any equipment used for waste compaction shall have a specified maximum rated capacity. **Note:** Consult the equipment handbook or your dealer.
- Compaction for residential solid waste, the in place waste density goal shall be to achieve greater than 1,200 lbs/cu yd in completed cells. The density shall be determined by dividing the total weight of waste received by the cubic yards of airspace used. The landfill density shall be computed annually per 401 KAR 48:070 sections 6 and 7.
- Each landfill site shall include a building for maintenance of equipment. The building shall be large enough to hold the largest piece of equipment required for site operation. The building shall be heated for winter repair operations (401 KAR 47:070 section 9(2)). **Note:** The purpose of this building is to prevent equipment from freezing to the ground and to provide a safe and comfortable workspace for the mechanic.
- Soil sub-grade shall be proof rolled using a minimum 100,000 lbs loaded four tire scraper (twenty cubic yard size) or equivalent. This procedure and equipment shall be approved by the Cabinet per 401 KAR 48:080 section 3(3)(b)). **Note:** It is common industry practice to use the largest scraper heaped or loaded to the maximum limits. The purpose of this practice is to discover any voids or soft spots now rather than suffer liner damage later.
- Within two hours of receipt, the owner or operator shall spread wastes in loose layers (not exceeding twenty-four inches in depth) compacted to the maximum practicable density. The owner or operator shall use the equipment specified in the permit for compaction. The operator shall pass the equipment over 100 percent of the waste surface at least four times. Each loose layer shall be fully compacted before any additional waste is placed per 401 KAR 48:090 section 9(1).
- The owner or operator shall not place any object in the initial lift that could damage the bottom liner. The liner system shall be protected with

a layer of dirt, waste or similar blanket of material placed between the operating equipment and liner (401 KAR 48:090 section 9(3)). **Note:** Refer to the notice dated September 15, 1999 and letters dated November 17 and December 21, 2000 in the appendix of this manual for more information on this topic. Generally speaking, the owner should use lightweight equipment, such as a D-5 or equivalent, to push loose "fluff", gravel or tire chips around the newly constructed cell. Refer to the Sanitary Landfill section of this manual for a more detailed discussion on liner protection.

- The owner or operator shall not accept solid waste at a rate that exceeds the rated capacity of operational compaction and cover equipment available onsite as per 401 KAR 48:090 section 9(8). **Note:** Always consult the equipment handbook on your dealer.

RESIDUAL LANDFILL

- The owner or operator of a residual landfill shall operator the facility in such a manner as to ensure compliance with the EPS outlined in 401 KAR 47:030 as per 401 KAR 48:170 section 2(2). **Note:** This rule gives the manager and owner a wide leeway in choosing the proper equipment. The bottom line is to prevent harm to human health and/or the environment. Select equipment based on the type and amount of waste to be disposed, type of jobs to be performed and cost considerations. Please consult with your equipment dealer.

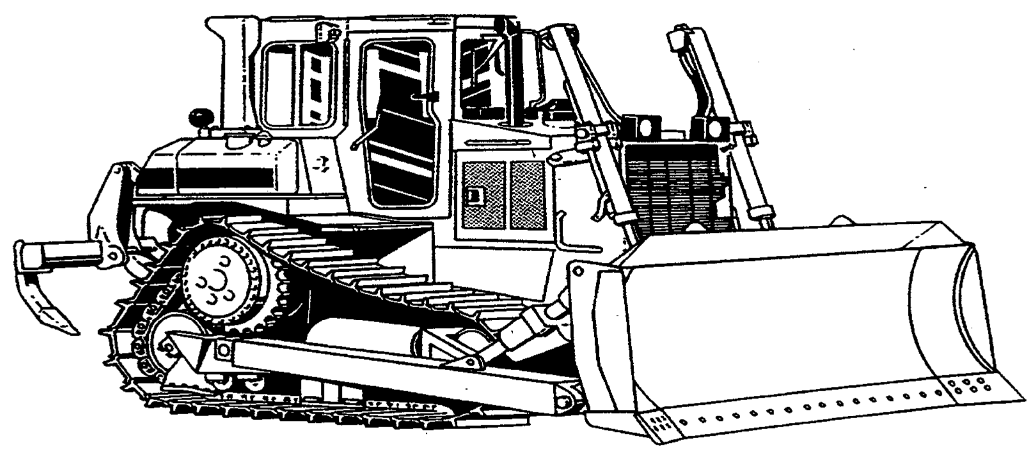
CONSTRUCTION

- The construction quality control plan shall provide assurance that the layers of homogeneous low permeability soil liners, if required, are compacted using non-vibratory compactors with full depth penetrating feet with a minimum of six passes per soil layer. The compacter ballast shall be varied to prevent reaching the desired proctor density within less than six passes. The foot length shall be one inch longer than the loose soil layer thickness (401 KAR 45:110 section 2(2)(a)).
- Smooth roller may be used at the end of each work period to seal the surface from rain infiltration (401 KAR 45:110 section 2(2)(b)).

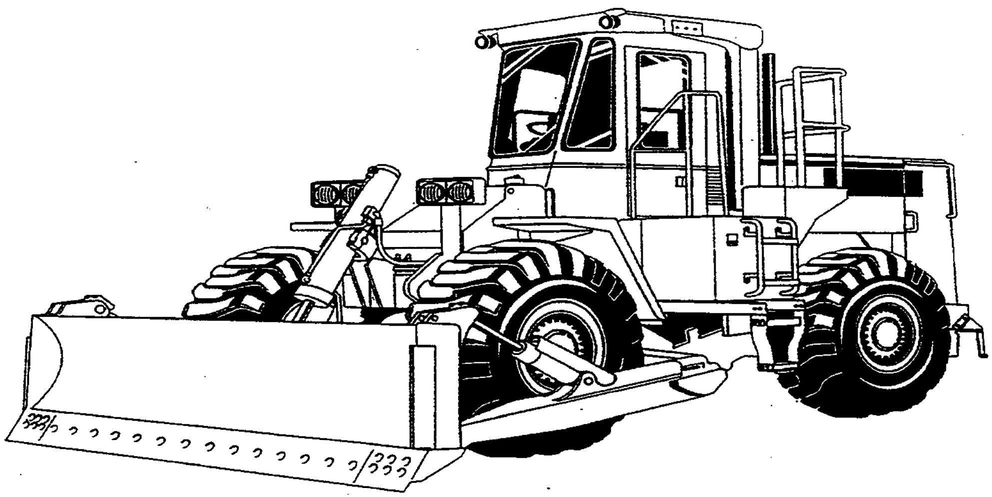
SPECIAL WASTE

- The owner or operator of a special waste landfill shall operate the facility in such a manner to ensure compliance with 401 KAR 30:031 (401 KAR 45:110 section 3(2)). **Note:** This rule gives the manager and owner a wide leeway in choosing the proper equipment. The bottom line is prevention of harm to human health and/or the environment. Select equipment based on the type and amount of waste to be disposed, type of jobs to be performed and cost considerations. Please consult with your equipment dealer.

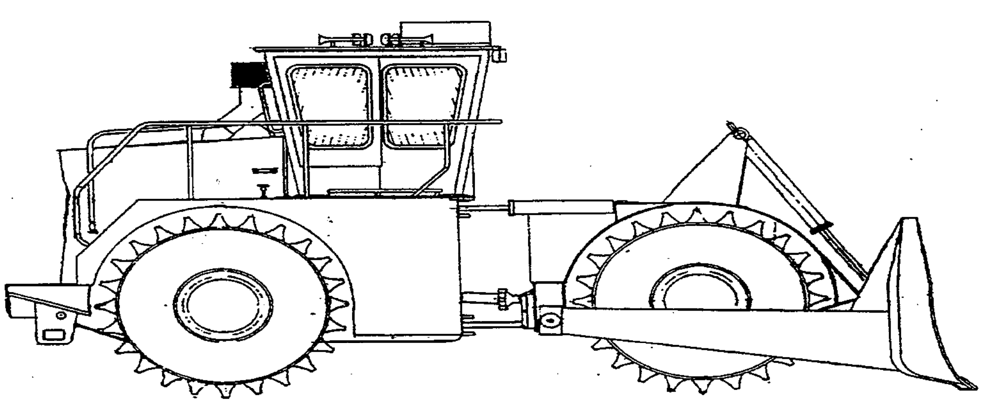
TRACK-TYPE BULLDOZER



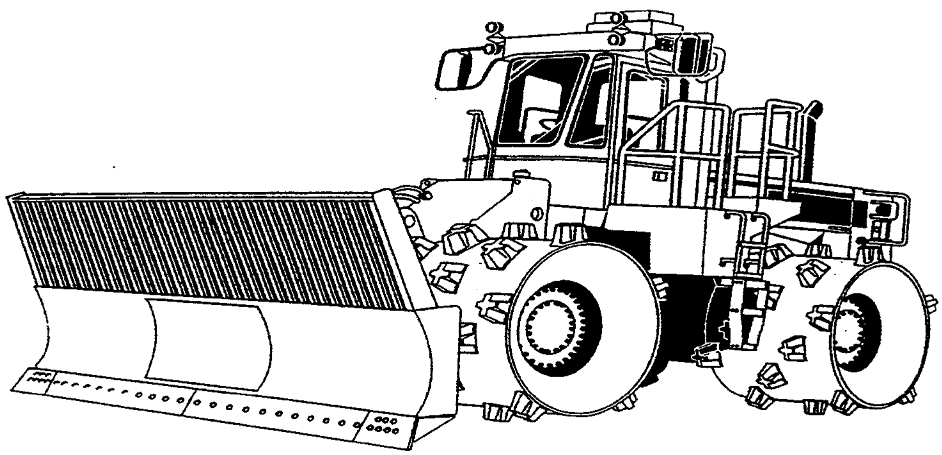
RUBBER TIRE BULLDOZER



STEEL WHEEL LANDFILL COMPACTOR

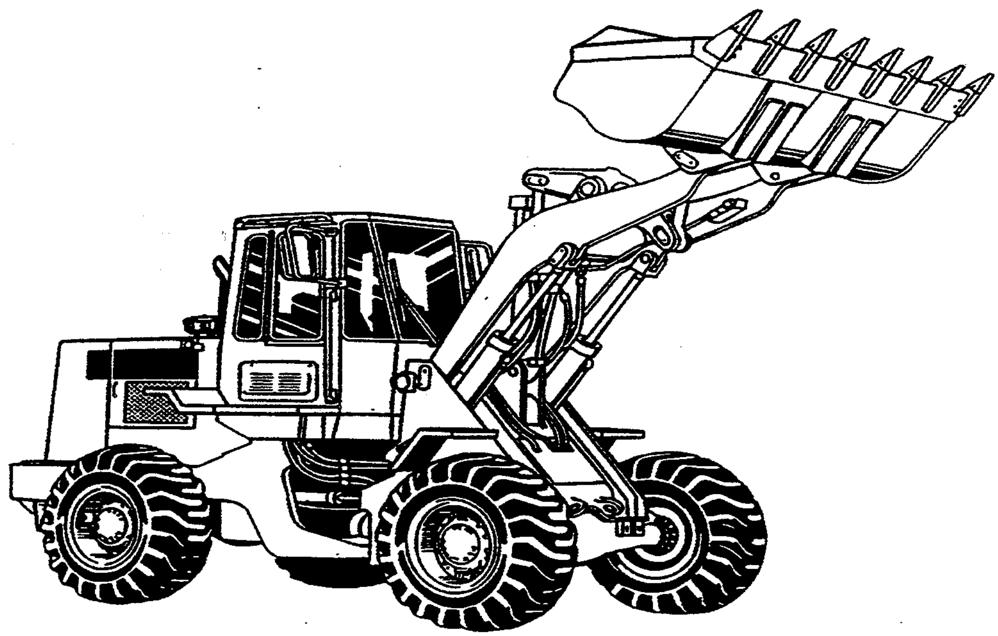


STEEL WHEEL LANDFILL COMPACTOR

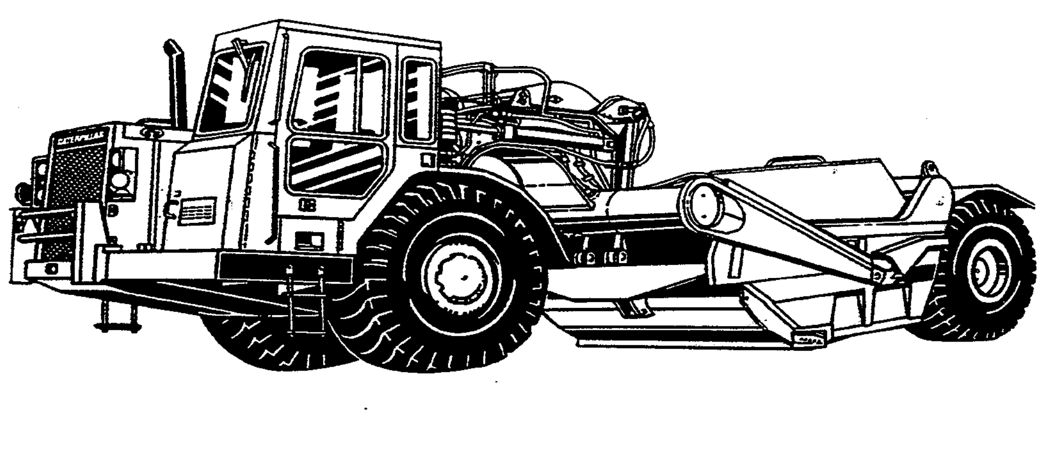


TRACK-TYPE LOADER

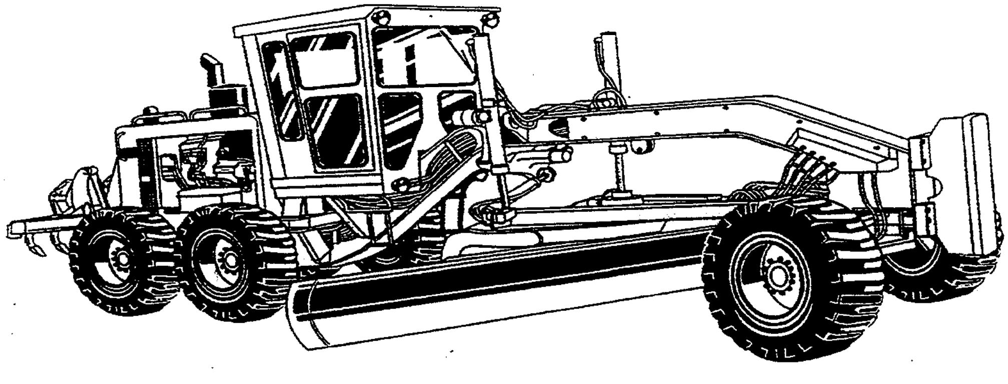
RUBBER TIRE LOADER



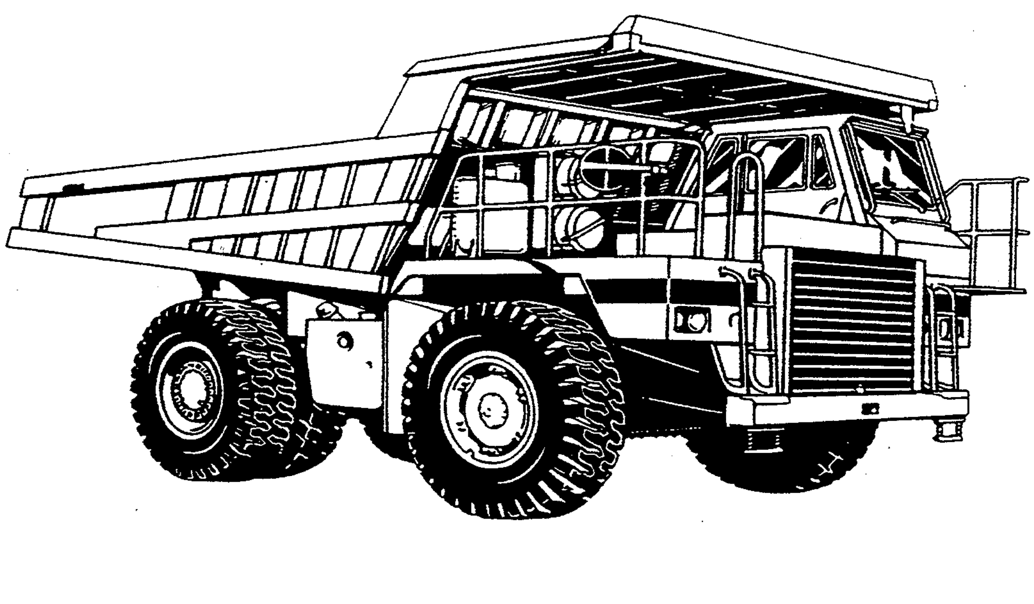
SELF PROPELLED SCRAPER



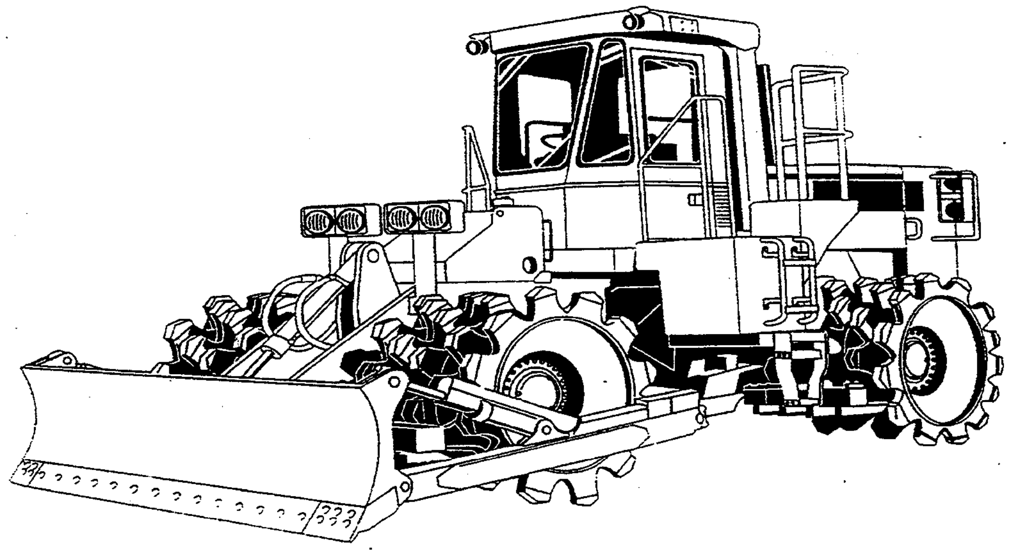
MOTOR GRADER



OFF-ROAD TRUCK



STEEL WHEELED SOIL COMPACTOR



STUDY GUIDE
LANDFILL EQUIPMENT

1. Purchasing the proper type of equipment for a landfill should be based on what operational considerations?

____

____

____

2. List the advantages and the disadvantages for the following types of equipment:

DOZER - TRACK-TYPE

Advantages:

____

____

____

____

____

Disadvantages:

____

____

____

DOZER - RUBBER TIRES

Advantages:

Disadvantages:

STEEL - WHEELED COMPACTORS

Advantages:

Disadvantages:

FRONT - END LOADER - TRACK-TYPE

Advantages:

Disadvantages:

FRONT-END LOADER - RUBBER TIRE

Advantages:

Disadvantages:

SCRAPERS

Advantages:

____

____

____

Disadvantages:

____

____

____

3. Equipment extras and/or modification for landfill machinery would include:

A heavy-duty ______________________ to protect motor and transmission from damage. An extra-heavy radiator ______________ to protect the radiator. A dozer blade that can push _______ – ________ lb./cu. yard of dirt and ____ lb./cu. yard of solid waste without taxing the machine. A bucket equipped with a _________ ____________. An _______________ canopy or equivalent offers safety protection for the operator. A _______ _____________ mounted in operator's compartment.

4. List main reasons why proper maintenance of equipment is considered a must:

____

____

____

____

5. _______________ landfills are required to have an equipment operating and maintenance recordkeeping program.

6. List items that should be checked on a daily basis:

7. Before operating a piece of equipment, it is necessary to check what liquid levels?

8. List the last step under shutdown procedures as outlined in the manual:

9. A periodical maintenance program would include the following every:

125 hours

250 hours

500 hours

____

1000 hours

____

____

10. Any equipment used for compaction shall have a minimum gross weight of ______ pounds, a minimum of ______ engine horsepower, a minimum gross ground pressure of _____ pounds per linear inch of wheel width.

11. The equipment manufacturer has a recommended schedule for preventative maintenance services. Follow this recommended schedule for each machine should include:

____

____

____

____

____

12. Soil sub grade shall be proof-rolled using a minimum _____ pound loaded four-tire scraper (20 cubic yards) or equivalent.

CHAPTER 8
FACILITY MANAGEMENT

This section describes management responsibilities regarding all phases of the landfill (planning, financing, monitoring, closure, etc.), personnel management and public relations.

Landfills are privately or publicly owned. Depending on the size of the operation and/or whether the operation is contracted to another party, a landfill may have one or more individuals responsible for management of the solid waste site or facility. Management responsibilities include:

- Planning,
- Designing,
- Financing,
- Permitting,
- Cost accounting,
- Overseeing the operation (operating plan),
- Recruiting and training personnel,
- Public relations,
- Compliance,
- Site closure, and
- Closure care maintenance.

PLANNING

Kentucky law requires each county or multi-county district to prepare, adopt, and implement a comprehensive Solid Waste Management Plan. The purpose of the plan is to analyze all solid waste management issues in the county, evaluate the existing system and propose for implementation a means of managing (both short and long term) the county's solid waste.

Disposal (landfilling) is one issue addressed in this process. Each plan gives a detailed description of the facility where the county's waste is disposed. The description includes the:

- Name,
- Type,
- Location,
- Life expectancy,

- Ownership,
- Operational costs,
- Cost to users, and
- Levels of compliance with all state and federal laws.

The county is responsible for obtaining a formal agreement with the disposal facility to assure acceptance of their waste through the short term planning period. Where no permitted facility is currently available to the area, the plan identifies an alternate site to be utilized and describes the strategy that is to be undertaken to obtain access to a disposal facility. The intent is to describe how residents within the planning area will, within the short term planning period, dispose of their waste in an environmentally and legally sound manner.

The governing body is ultimately responsible for the preparation and implementation of the approved solid waste management plan. Therefore, the manager of a landfill should consult with local officials on a regular basis. If changes arise in current disposal methods that will affect the community's short or long term needs, whether it is due to changes at the existing disposal site or decisions by the fiscal court, further planning will be required and the county's plan will need to be modified. Substantial changes to the plan must be public noticed to ensure that all entities within the solid waste management area are advised.

As a result of KRS 224.40-310, all landfill applications for contained, residual and construction/demolition/debris (and any additional capacity expansions) must first be submitted to the local solid waste management area's governing body. The governing body makes a determination concerning the consistency of the application with the area solid waste management plan within sixty days.

The applicant submits a Notice of Intent to apply for expansion to the Division. This constitutes the start of the Cabinet's 180 working day review time. After a review of the Notice of Intent, Administrative and Technical Applications, a preliminary determination is made to issue a permit. At this time, a written finding by the Cabinet is made regarding consistency with the state and area solid waste management plan.

ESTIMATING WASTE VOLUME AND TYPE

In order to estimate the daily quantity of residential and commercial waste for the area, one multiplies a generation rate (e.g., pounds per capita per day) by the population. For an average community, this approach will provide a rough, first cut estimate of the amount of waste discarded each day. The reliability of the estimates will be improved if weight data exists to develop a local generation rate, rather than rely on a nationwide rate. Future waste estimates must account for both population growth and increases in generation rates. EPA uses currently 4.4 pounds per capita per day as a national average, up from 2.7 in 1960 and 3.7 in 1980. This figure is holding steady. See figure 1, taken from CHARACTERIZATION OF MUNICIPAL SOLID WASTE IN THE UNITED STATES 1998 UPDATE.

For more information, visit the EPA's website on Municipal Solid Waste at http://www.epa.gov/garbage/facts.htm or http://www.epa.gov/epaoswer/non-hw/muncpl/mswrpt98/98charac.pdf.

Industrial waste estimates are obtained by contacting the specific plant of multiplying an industry wide generation rate, by manufacturing type, by the number of employees in the industry.

Waste quantity will vary with the season of the year due to changes in composition. The calculated waste quantity will only be an average and will fail to reflect high and low periods of waste generation. During the summer, waste quantity is typically at its highest and is at its lowest in the winter.

DESIGN

Managers are usually not directly responsible for designing a landfill. An engineer performs this task. However, the manager must work closely with the design team to see that everything regarding the particular site and waste volumes received or anticipated is considered in the design phase. To assure that the site is operated well, the manager is also responsible for:

- Knowing the regulatory and statutory requirements,
- Knowing the contents of the permit document, and
- Reading and interpreting the engineering plans.

LANDFILL COSTS

The following costs can be associated with a landfill:

Pre-development

- Land cost,
- Design fees ($2 to $3 million for a contained landfill),
- Permit fees (see 401 KAR 47:090),
- Legal fees (see your lawyer), and
- Financing costs (see your banker).

Site Preparation and Construction Costs:

- Access road,
- Sign and gate,
- Scales,
- Fencing,
- Clearing and grubbing,
- Topsoil excavation and placement,
- Subsoil excavation and placement,
- Off site soil hauling,
- Leachate collection system (piping, backfill material, manholes, lift station, tanks),
- Drainage controls (ditches, sediment basin), and
- Erosion controls.

Operation:

- Equipment,
- Labor,
- Fuel,
- Utilities,
- Maintenance,
- Supplies,
- Administrative costs,
- Leachate collection, hauling and treatment (control surface water!),
- Annual fees (see 401 KAR 47:090),
- Monitoring,
- Engineering,
- Map updates and annual survey, and
- Garbage collection system maintenance.

Site Closure:
- Final cover (cap),
- Topsoil (stock piled),
- Seed, fertilizer and mulch,
- Gas venting,
- Building removal and site restoration, and
- Documentation of closure.

Post Closure Site Care and Maintenance:
- Monitoring,
- Groundwater,
- Surface water,
- Leachate,
- Gas,
- Leachate hauling and treatment,
- Collection system maintenance,
- Site inspections,
- Corrective action, if any, and
- Final certification.

EQUIPMENT FINANCING

Although landfills use the same type equipment as other construction projects, the areas of financing and accounting are very different. Landfills operate for long periods of time, often 20 to 30 years and revenue is based upon quantities of wastes delivered for disposal.

Cost Projections

Cost projections should cover a ten (10) year period since the life of equipment is frequently 6 to 8 years. The purpose of cost projections is to determine whether expected revenues are likely to cover expected costs. However, this information can be the basis for many management considerations (adjusting tip fees and permit expansions for purchasing or delaying the purchase of equipment, etc.). Annual costs should be used to calculate cost projections. To develop cost projections, the following are needed:

- Financial reports for at least the current year, but preferably 2 or 3 years,
- Quantities of waste received for the last 2 or 3 years,
- Remaining life of the equipment, and
- Site excavation and grading original costs.

Clearly, a 10 year financial projection cannot be accurate for more than 1 or 2 years as conditions change. Nevertheless, long range plans and goals are needed and should be made. The projections should be updated and extended each year to show current thinking and to cover a 10 year span. The best long-range financial projections are based on sound records of costs, revenues and quantities and types of wastes received.

Equipment Economics

Knowing the right time to replace a piece of equipment can have great economic impact on your operation. Trying to pinpoint the best time to replace a piece of equipment is a difficult task. For this reason, changes are too often made on a hit or miss basis. In order to determine the most economical replacement time, accurate records of maintenance and repair costs and downtime must be kept for each machine. The factors that need to be studied can be grouped into 5 major headings – depreciation/replacement costs, investment costs, maintenance and repair costs, downtime costs and cost of obsolescence.

Depreciation and Replacement Costs

Depreciation cost is the out-of-pocket expense due to the decline in actual value of a machine because of usage and age. It is the difference between the initial price paid and the price obtained for that machine when sold or traded. Depreciation has become an important factor in recent years because true depreciation costs for landfill equipment are increasing. The greatest proportion of depreciation occurs within the first few years. This has been a result of rapid new product development and manufacturers and changes, which increase machine productivity. The depreciation rate is also dependent upon type of machine, manufacturer, geographic location and service and parts availability.

Replacement cost is a result of the rising price of new machinery and the shrinking purchasing power of the dollar. By looking at wholesale price index, one may determine the annual average increase in price as a percentage. Using this one can project the future cost of a new piece of equipment.

While the loss on replacement is increasing each year, the hours most machines are worked are also increasing. This results in a yearly decrease in depreciation and replacement cost. If this were the only factor in a replacement program you would retain the unit indefinitely. But the other factors must be considered.

Investment Costs

Whether a piece of equipment is purchased by cash, installment contract, rental purchase or leased, there is some type of interest charge, finance expense, insurance and/or tax which must be charged against each machine in order to determine the true cost.

If a unit is rented or purchased on an installment contract, most of the interest is the result of the charges for financing the transaction. However, on a cash purchase the interest charge against a machine is that which would be earned if the same amount of money were invested elsewhere. The investment costs per cumulative hour decreases, as a machine grows older, favoring retaining a machine indefinitely.

Maintenance and Repair Costs

The largest operating expense for landfill equipment is the cost of maintenance and repairs. Over the useful life of a machine, an amount equal to the purchase price could be spent to maintain it. Since maintenance and repair costs vary, individual machines will show an irregular pattern. This is a result of major overhauls or extensive repairs such as tracks, engines and transmissions, which cause unusually high costs in the year in which they occur. For this reason, it is important that machine cost records be kept for each individual machine. If the cost of maintenance and repair were the only factors to be considered, you could conclude that machines should be traded every year to avoid the headaches of increasing costs and downtime.

Downtime Costs

As the amount of work a machine does increases, the cost of lost time due to machine breakdown also increases. With the trend toward more productive machinery, it is imperative that downtime be considered as an operating expense.

While new machines will have greater availability, normal usage will result in increased downtime as a machine grows older. Since downtime can vary greatly according to the make, age and preventive maintenance of a given machine, each owner should use his own records in computing downtime expense. Even with conservative estimates, downtime costs would heavily favor trading a machine every year.

Obsolescence Costs

While the model designation of a machine may be retained for may years, the productive capacity of that machine may be increases many times during the period. Machines of even five years ago are no match for today's more powerful and more productive models.

While the production potential of landfill equipment has grown by an average of five percent per year, the increases do not necessarily follow a smooth curve, but may arise sharply with the introduction of a new model. Here again, the conclusion is a simple one if only the effects of productivity or obsolescence are considered. This could lead an owner to trade every time a new model is introduced.

When to Trade

Some factors favor retaining a machine while others favor trading. There is never a situation in which these factors occur independently of one another. All of them exert their influence at the same time and their total effect points to the most economical time to replace a machine.

In looking at manufacturer's average for all five factors one would see that the most economical time to trade a machine would be at the end of every third year. This does not mean that every operator should trade every machine every three years.

Whether considering new or used equipment, the important point to consider is in every operation there is one ideal time to replace any profit producing capital investment. Only by applying the effects of all influencing factors can the proper decision be reached.

Equipment Financing

Whether you are selecting equipment for the first time or replacing an older model, there are several considerations and methods of financing.

<u>Outright Purchase</u>

- Like buying a car,
- Pay cash or borrow a prevailing interest rates,
- Lender may require insurance, prepayment penalties or collateral, and
- Don't just buy the cheapest machine, it may cost more considering maintenance, repairs and downtime.

Low Bidder

- May get a lower price than outright purchase,
- Need a strong bid document (bidding specification) so that you get the right piece of equipment for the job, and
- Consider parts availability, resale value and specification of machines you know can do the job.

Total Cost Evaluation (TCE)

This is a method of looking at the overall costs before selecting a machine. For this system to work it is important to have good records for the size and type of equipment being considered. If records are unavailable, check with other operators that may have similar equipment. Items to consider include:

- Purchase price,
- Interest,
- Insurance
- Taxes,
- Maintenance, repairs and cost of downtime, and
- Loss of resale value (depreciation).

This is the only method to evaluate the total cost.

Total Cost Bidding (TCB)

Use the total cost evaluation to help in the bidding procedure and require that the bidder submit quotes on:

- Purchase price, less trade in,
- Guaranteed maximum cost for repairs for a set time frame, and
- Guaranteed minimum repurchase price at a specified time.

Pros and Cons of this method of purchase

- Simplifies budgeting task,
- Forces bidders to evaluate performance,
- More likely to match machine with task,
- May lock you into doing business with the same outfit, and
- Guarantees will probably make the bid higher.

Guaranteed Maintenance Purchase
- Same concept as total cost bidding,
- Omits guaranteed repurchase, and
- Advantage to you is the increasing value of used equipment.

Lease-Purchase
- Conserves capital,
- You pick out the machine you want with any or all options,
- Leasing company buys it and then leases it to you for a specified time,
- Lease payments can be applied against the purchase price,
- May be able to get equipment that you are not able to purchase outright,
- Lease payments that are applied to the purchase price may be higher than the interest cost of an outright purchase, and
- Some of the costs may be tax deductible.

COST ACCOUNTING

Choose a system, with the advice of your accountant, that looks at the overall costs of a landfill, including equipment amortization and future construction, operations, closure, post closure and monitoring costs.

The U.S. EPA recommends that cities and counties look at the overall costs of a municipal solid waste collection and disposal system using Full Cost Accounting. Full cost accounting (FCA) provides decision makers with a method of compiling detailed cost information on MSW services in their communities. Knowing what MSW management really costs enables local government officials to make informed decision about their programs, identify opportunities for streamlining services, facilitate cost saving efforts and better plan for the future.

FCA is different from other common government accounting practices. It help decision makers understand the direct and indirect operating costs of MSW services, as well as upfront (past) and backend (future) expenses. Through FCA, decision makers systematically identify, analyze and report all the monetary costs of resources associated with MSW management activities, including:

- Acquisition of equipment and materials,
- Siting and construction of facilities,
- Collection and disposal of MSW,
- Collection, processing and marketing of recyclables,
- Transportation,

- Operation and maintenance of facilities (e.g., transfer stations, landfills and materials recovery facilities),
- Clean up of illegal dumping sites,
- Landfill closure and post closure,
- Program promotion, and Administration/overhead.

Many local governments use cash flow accounting, which is based on cash outlays (when the cash flows) and not on costs (when the resource is used). These costs can be obscured using cash flow accounting because communities can incur insignificant expenditures before and after the operating life of specific management services. For example, in cash flow accounting systems, capital expenditures for garbage trucks and recycling equipment are recognized entirely in the year of purchase, while FCA spreads the expenditures over the useful life of the item. Also, cash flow accounting does not consider future costs that are directly related to current activities, such as landfill closure and post closure. For all these reasons, cash flow accounting can give a distorted picture of the actual costs of MSW management.

FCA recognizes upfront, operating and backend costs.

Upfront costs include:

- Acquisition of building, vehicles, equipment and landfills,
- Operating costs include salaries and wages, power and fuel, supplies,
- Tipping fees, and
- Indirect (overhead) costs including services such as:
  - ✓ Executive oversight,
  - ✓ Legal services,
  - ✓ Data processing,
  - ✓ Billing, and
  - ✓ Purchasing.

Backend costs include:

- Landfill closure and post closure, and Retirement benefits.

FCA does not take into account environmental, health and social costs. These costs cannot be measured easily or valued readily in the marketplace. Consideration of the full spectrum of costs could be called “true cost accounting” or “environmental accounting”, which is beyond the scope of FCA. FCA is a method of accounting for all monetary costs of resources used or committed, thereby providing managers with the whole picture of MSW management costs on an ongoing basis. It goes beyond the limits of cash flow accounting, but does not negate cash flow principles.

Private companies should use the same principles of FCA in their planning, forecasting and accounting systems.

For FCA publications, visit the EPA's website at:
http://www.epa.gov/fullcost/docs/epadocs.htm#fcahandbook.

OPERATING PLAN

The permit documents and regulations, as they are currently prepared, do not provide concise guidance for the systematic operation of a landfill. These documents serve multiple purposes. Therefore, it is incumbent upon the owner or operator to prepare a written plan to detail the duties of the operator(s) and the manager such that the landfill is economically operated and stays in compliance with its permit.

For the Site Operator

Daily

- Opening the site,
- Safety checks,
- Check equipment,
- Designate areas to fill,
- Supervise unloading,
- Movie daily cover or Alternate Daily Cover Material (ADCM),
- Spread and compact waste,
- Record waste sources and volumes received,
- Record any random waste inspections,
- Monitor industrial and commercial waste streams,
- Perform leachate system checks,
- Finish daily waste placement, and
- Apply daily cover or ADCM.

Weekly

- Maintain and service equipment, and
- Perform the OSHA safety review with operating personnel.

Monthly

- Check leachate systems,
- Check application of interim cover,

- Re-grade cover for erosion,
- Install erosion control measures,
- Verify proper borrow pit location and waste placement,
- Check surface water drainage in waste area, and
- Check equipment services.

Semi-Annually

- Maintain erosion controls, and
- Re-seed bare spots.

Annually

- Apply 18 inch thick long term (winter) and final cover.

OPERATING PLAN (SITE MANAGER)

Daily

- Document the amount/area and location of daily cover or ADCM applied,
- Verify that operators are onsite and complete daily assignments, and
- Verify that operators know where to place waste and otherwise operate per the permit.

Weekly

- Visit site,
- Assure that the operation is in compliance with the operating scheme of permit,
- Review records,
- Review accidents and safety, and
- Verify equipment maintenance.

Monthly

- Survey landfill by expedient means to verify progress of fill per plans,
- Designate areas to receive interim or long term cover,
- Direct erosion control measures,
- Monitor methane levels,

- Conduct water samples,
- Verify borrow pit usage is acceptable per the plans, and
- Review performance against regulations and permits.

Quarterly

- Sample and report groundwater,
- Sample and report surface water,
- Sample and report methane,
- Document and report construction requirements,
- Report wastes received monthly,
- Report soil cover applied, especially interim, long term and final,
- Report leachate disposal,
- Report monthly volume of wastes by source for residual and special wastes landfills; weight by source for contained and C/D/D landfills,
- Re-vegetate, and
- Review regulations, permit and operating plan versus actual operations.

Annually

- Evaluate fill progress,
- Evaluate costs per ton,
- Determine remaining life volume, and
- Submit survey on remaining landfill life. For contained landfills, determine the compaction rate.

COMPACTION RATE

One of the most important checks for a landfill manager involves maximizing the waste compaction rate for the site. For example, the difference between 1,100 to 1,200 lbs/cu yd of garbage density over a 1,000,000 cu yd site which has a $25 per ton tipping fee results in an additional gross profit of $1.25 million without construction of additional airspace. Another way to look at the savings is at 500 tons per day of incoming wastes, a four month postponement for construction of the next cell.

Please refer to two articles by Neal Bolton on the subject at the end of this chapter. The articles are reprinted by permission from MSW Management at http://www.mswmanagement.com.

PERSONNEL MANAGEMENT

To secure and retain competent employees, the facility must have a systematic personnel management plan, including:

A job description for each position listing:

- Administrative tasks such as:
    - ✓ Management,
    - ✓ Accounting,
    - ✓ Billing,
    - ✓ Engineering, and
    - ✓ Word processing/filing.

- **Operating tasks including:**
    - ✓ Weighing,
    - ✓ Maintaining equipment,
    - ✓ Operating equipment,
    - ✓ Spreading,
    - ✓ Compacting,
    - ✓ Excavating,
    - ✓ Hauling,
    - ✓ Road maintenance,
    - ✓ Dust control,
    - ✓ Traffic routing,
    - ✓ Vector/litter control, and
    - ✓ Site security.
- Determine how many employees are needed (depends on size of operation),
- Interview and evaluate potential employees, and
- Hire and train employees.

Employees should thoroughly understand work rules, benefits and procedures for reprimands and grievances.

Training programs should emphasize the overall operation of the landfill and should include:

- Conditions of the facility permit and plans in relation to job function,
- Operational requirements and methods,
- Daily equipment maintenance,
- Importance of small tasks in accomplishing the overall objectives, and
- Safety training and emergency procedures.

COMMUNICATION

Effective communication is a necessary skill for the manager. This is one of the keys to having an operator do a good job. To have it, the manager must:

- Be aware of attitudes, habits and performance,
- Have patience,
- Don't assume,
- Motivate,
- Recognize (compliment for job well done),
- Make opportunities for advancement, and
- Reward.

PUBLIC RELATIONS

Public relations is one of the manager's most important functions. Solid waste disposal sites represent an extremely emotional issue, particularly to those who live in the vicinity of a site. Many sites are acceptable from an environmental control aspect, but are vigorously opposed by citizens who associate them with old fashioned open dumps with bad odors, flies and rats. However, through explanation and education the public can be convinced of the advantages.

PUBLIC INFORMATION

Public information should stress that:

- Waste is covered daily,
- Access is restricted,
- Insects and rodents are controlled,
- Open burning is prohibited,
- Monitoring controls exist (groundwater, surface water, methane gas),
- Liner requirements exist, and
- Mechanisms exist for local government to hire an enforcement officer to monitor the site.

In addition, the benefits of the post closure use of the site (park, playground, golf course, etc.) should be emphasized.

The media available to the manager includes:

Newspapers	Collection vehicles
Billboards	Garbage haulers
Radio	Billing receipts
Television	Elected or appointed officials

FACILITY OPERATION

Citizens of the community are your customers. For this reason, there are several factors you must consider when scheduling operations:

- Community needs,
- Labor scheduling,
- Incoming waste quantity,
- Time needed to accomplish tasks,
- Neighbors and effect of the operation on them, and
- Season.

Hours of operation are a permit condition and must be consistent so people will know when the facility is open. In addition, the Division must be notified of any change in hours.

FACILITY APPEARANCE

First impressions are the most lasting. Cluttered and unorganized looking facilities portray the image of a shoddy operation. On the other hand, neat, well organized facilities give the general public confidence in your operation, thus resulting in few complaints. Items that can assist with giving an organized appearance include:

- Facility sign,
- Traffic signs to the working face or unloading area,
- Mowed grass,
- Neat entrance and facilities,
- Well organized salvage areas, and
- Other operational consideration such as litter, odors, insects and rodents.

GENERAL RULES FOR HANDLING COMPLAINTS

- Listen to the complaint and get all details,
- Repeat the message to confirm your understanding,
- Explain your company's position and policy,
- Tell the customer what will be done and when,
- Handle complaints quickly,
- Follow through to be sure the complaint is solved,
- Confirm the complaint has received a satisfactory response and thank the customer,
- Inform public of services, your responsibilities and theirs,
- Be professional when handling the public and they will do the same,
- Honesty is best policy when interacting with the public, and
- Don't' demand respect; respect is not given it is earned.

COMPLIANCE MONITORING

Inspections

- Routine inspections are conducted every 4 to 6 months by the Cabinet,
- Operators are not notified in advance,
- Inspection form is located in appendix E,
- Photographs are used to document findings and sampling is conducted as needed,
- Finding are discussed with operator after inspection,
- Inspector mails the final inspection later after supervisory review, and
- If no violations are observed, no further action is taken.

Violations

Violations are marked and described on the inspection report. The violations noted are documented on a Notice of Violation (NOV), which outlines remedial measures and compliance dates. A follow-up inspection is performed to determine if the violation was corrected by the specified date. Depending on the severity of the violation, the case may be referred for enforcement action or considered as resolved.

ENFORCEMENT

- Violations may be referred to the Enforcement Branch for further action,
- If so, an Agreed Order may be drafted and forwarded to permittee,
- Owner or operator may sign the Agreed Order or request a meeting,
- Meeting is held and terms of the agreement are discussed. Agreed Order (example is included in appendix E) is forwarded to permittee for signature, and
- **Penalties are assessed in the Agreed Order:**
  - ✓ If the permittee does not comply with the Agreed Order, the case will be referred for an administrative hearing, or
  - ✓ For serious or continued violations, the Division may seek an injunction to close the landfill through Franklin Circuit Court.

LANDFILL CLOSURE PROCESS

The closure of a landfill is a process that is intended to achieve an environmentally acceptable and stable condition. The owner or operator must begin closure in those areas that have received final waste within 30 days. The process involves the following actions:

- Stop taking waste in the area to be closed,
- Re-grade for positive drainage, future settling and erosion control,
- Place final cover,
- Fertilize and seed cover,
- Have site inspected,
- For C/D/D landfills: once grading and cover depth are acceptable to the Cabinet, machinery may be removed from site (401KAR 48:060 section 3(1)(e)),
- Apply erosion control measures,
- Establish vegetative cover,
- Request inspection to start closure and post closure periods:
  - ✓ Contained landfill: 2 year closure and 30 year closure care (post closure),
  - ✓ C/D/D: 2 year closure,
  - ✓ Residual: 2 year closure, and
  - ✓ Special waste: 5 year post closure.
- Maintain site for required period,
- Request final inspection,
- Modify deed notice to warn purchasers of disposed wastes, and
- Request release of site and any bonds.

STUDY GUIDE
FACILITY MANAGEMENT

1. List the responsibilities of the landfill manager.

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2. The purpose of the plan is to analyze all solid waste management issues in the __________, evaluate the existing ___________ and propose for implementation a means of managing the county's ____________.

3. All landfill applications for contained, residual, and construction/ demolition/debris (and any additional capacity expansions) must first be submitted to the ___________________________.

4. EPA uses currently _____ pounds per capita per day as a national average, up from 2.7 in 1960 and 3.7 in 1980. See CHARACTERIZATION OF MUNICIPAL SOLID WASTE IN THE UNITED STATES 1998 UPDATE.

5. Waste quantity is typically highest in the ________ and lowest in the __________.

6. A manager, in addition to knowing the statutory and regulatory requirements of a permit document, must also be able to _______ and ___________ the engineering plans to assure site compliance.

7. Name the five major categories of costs that can be associated with a landfill:

____

____

____

____

____

____

8. The following operational costs can be associated with a landfill:

____

____

____

9. The largest operating expense for landfill equipment is the cost of ________________ and ________________.

10. Total Cost Evaluation (TCE), a method to determine the total cost of equipment, includes four items to consider:

____

____

____

____

____

11. Depreciation cost is the _______________ due to the decline in actual value of a machine because of usage and age. It is the difference between _______________ and the ____________ ________________. Depreciation has become an important factor in recent years because true depreciation costs for landfill equipment are _____________. The greatest proportion of depreciation occurs within the ____________ _______________ This has been a result of rapid new product development by manufacturers and changes, which increase machine ________________. The depreciation rate is also dependent ____________________ ________________ ______________________.

12. Full Cost Accounting is different from other common ____________ accounting practices. It helps decision-makers understand the direct and indirect operating costs of MSW services, as well as __________ (______) and __________ (_________) expenses. Through FCA, decision-makers systematically identify, analyze, and report all the _____________________________ associated with MSW management activities. Many local governments use cash flow accounting, which is based on _____________ _____________.

13. FCA does not take into account ________________, __________, **AND** _________ __________.

14. An operating plan should list **DAILY**, **WEEKLY**, **MONTHLY**, **SEMI-ANNUAL**, and **ANNUAL** duties for an operator. Give two examples of duties for each time frame:

DAILY

____

____

____

WEEKLY

____

____

____

MONTHLY

SEMI ANNUALLY

ANNUALLY

15. Give two examples of a manager's duties as outlined in an operating plan for the time periods identified:

DAILY

WEEKLY

____

____

____

MONTHLY

____

____

____

QUARTERLY

____

____

____

ANNUALLY

____

____

____

16. One of the most important checks for a landfill manager involves maximizing the waste ____________________rate for the site.

17. Frequently in today's competitive environment, landfill managers will sacrifice compaction for _________________________________.

18. In the *MSW Management* Article "Landfill Airspace and Waste Density: The Big Picture" by Neal Bolton, the compactor on the 5:1 slope achieved _____________ tooth penetrations per day while the same machine on a 3:1 slope achieved ________ tooth penetrations per day.

19. To secure and retain competent employees, the facility must have a __________________ management plan.

20. A personnel management plan should enable employees to thoroughly understand:

____

____

____

____

____

____

____

21. Training programs should emphasize the **OVERALL** operation of the landfill and should include:

____

____

____

____

____

____

____

22. Public relations can benefit a landfill by stressing that a landfill:

____

____

____

____

____

____

23. Neat, well-organized facilities give the general public ___________ in your operation. This will result in fewer _________________.

24. Public relations are one of the manager's most important functions. Solid waste disposal sites represent a/an ____________ _____________ issue, particularly to those who live in the _________ of a site. Many sites are acceptable from an environmental control aspect, but are vigorously opposed by citizens who associate them with old-fashioned ____________________. However, through _______________ **AND** ________________ the public can be convinced of the advantages.

25. List the general Rules for Handling Complaints

____

____

____

____

____

____

26. To ensure compliance, routine inspections are conducted every ______ **to** _____ months; operators **are/are not** notified in advance.

27. For serious or continued violations at a landfill, the Division may seek a/an ____________ to ____________ the landfill through Franklin Circuit Court.

28. The closure process of a landfill is intended to achieve a/an _______________ _______________ and ________________ condition.

29. The owner or operator must begin closure in those areas that have received final waste within 30 days. The process involves the following actions:

____

____

____

____

CHAPTER 9
MONITORING YOUR LANDFILL

This section describes the types of information or data a manager needs to determine if landfill operation is proceeding as designed and is in compliance with the regulations and permit.

Monitoring is a process of collection information, comparing the information to the permit and determining compliance. Categories of data needed include:

- Permit and engineering drawings,
- Field measurements,
- Sampling requirements – surface and groundwater monitoring,
- Gas testing, and
- Waste volume data.

GENERAL UNDERSTANDING OF LANDFILL PLANS

Determining compliance with plans is a process of reading engineering drawings and checking site elevation and grade. Plans are scaled drawings that show existing and proposed conditions. To interpret plans one must understand plan scales, elevations, slope, area, volume, baselines and cross sections.

REAL MEASUREMENTS VS. PLAN MEASUREMENTS

Plan scale is the relationship between measurements on the plan and measurements on the ground. For example, one inch on the plan equals one hundred feet on the ground. To determine these distances, a rule is needed to measure the distance between the two points. A distance measured on the plan is multiplied by the plan scale to determine the actual distance on the ground.

Formula: measurement on plan (in.) x scale (ft./in.) = distance (ft.)

READING ELEVATIONS

Plan views use contour lines to show changes in elevation. They add a third dimension to a flat piece of paper. Contour lines:

- Always connect points of equal elevation,
- The closer the contour lines are spaced, the steeper the slope,
- Never cross (except for overhangs),

- Are always closed i.e. makes a rough circle (sometimes it takes more than one map),
- Lines that represent depressions have hachure marks that extend in the downhill direction, and
- When the lines cross running water (or dry streambeds) they always form V's that point upstream.

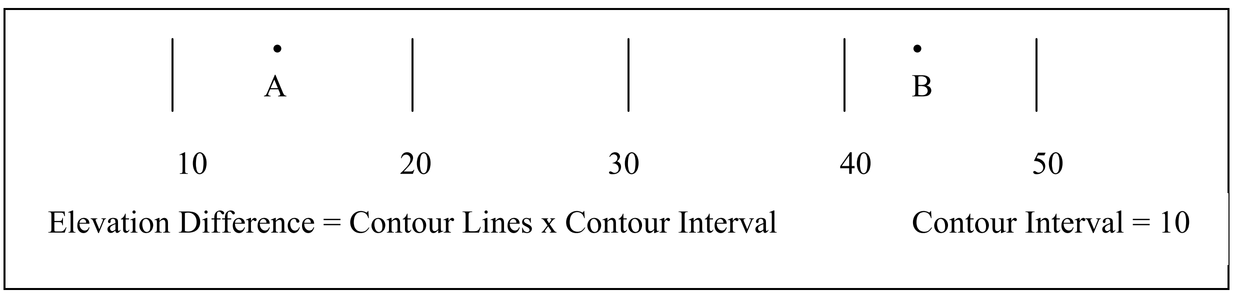
The formula for change in elevation using contour lines is:

Elevation difference = contour lines x contour interval

Example: Determine the change in elevation between points A and B in figure 9-1.

FIGURE 9-1

Case 1



Example: A is half way between 10 and 20. Estimate the height at 15. B is about 1/3 of the distance from 40 to 50. Estimate it at 43ft. The elevation difference is 43 ft. - 15 ft. = 28ft.

FIGURE 9-2

Case 2

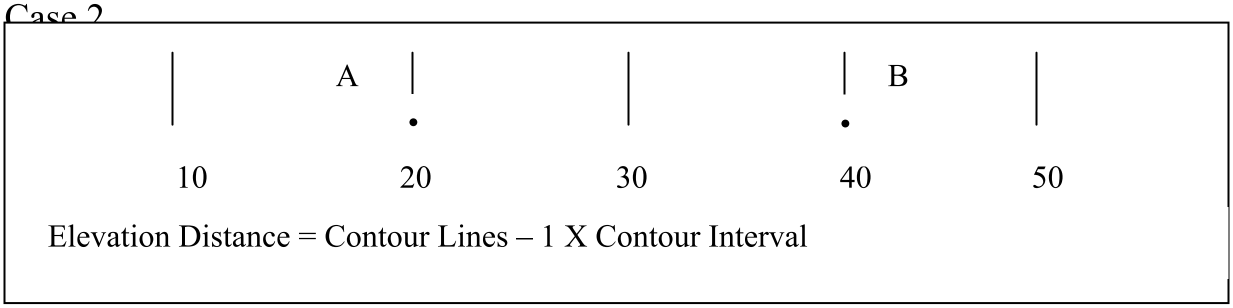
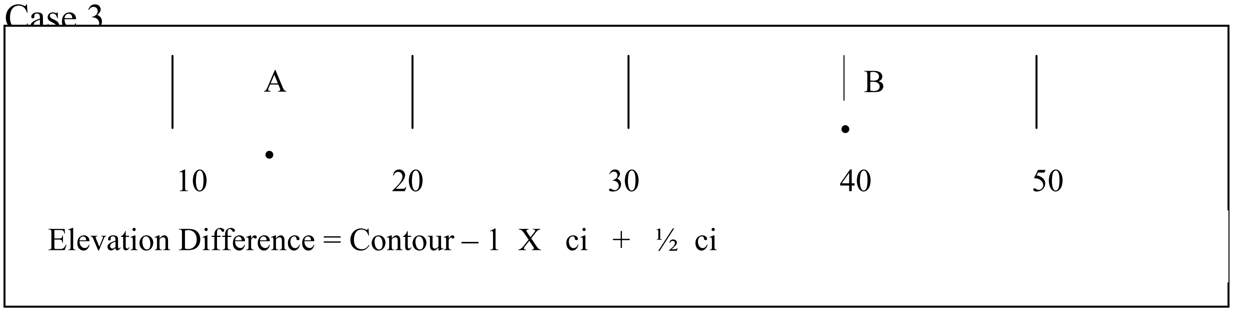


FIGURE 9-3

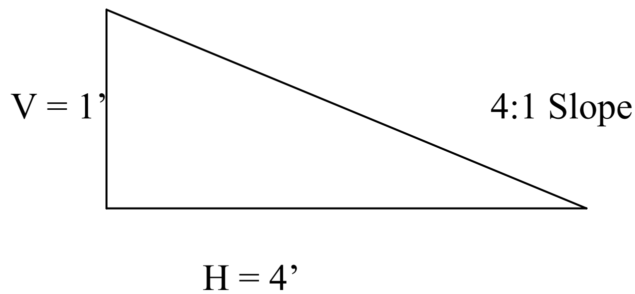
Case 3



SLOPE

Slope, either as a ratio (H:V) or as a percent (25%), is used to express steepness of a grade. When used as a ratio, the first number indicates the horizontal distance traveled and the second number indicates the difference in elevation. For a 4:1 slope, the grade changes one foot in elevation (vertically) for every four feet (horizontal).

FIGURE 9-4



To determine the percent of slope, horizontal distance and vertical change must be known. These can be obtained by using the plan scale and contour lines as previously discussed.

FORMULA: $\% \text{ SLOPE} = \dfrac{\text{Vertical distance (rise)}}{\text{Horizontal distance (run)}} \text{ X } 100\%$

Example: The formula below demonstrates how to determine the percent of slope for a baseline between two points that are 2,000 feet apart and differ in elevation by 102 feet:

$$\% \text{ slope} = \frac{120'}{2000'} \text{ X } 100\% \qquad = 5.1\% \text{ Slope}$$

$$\text{Slope Ratio} = \frac{H}{V} \text{ and is expressed as H:1V}$$

Using the above example: Slope ratio = $\dfrac{2000'}{102'} = 19.6 : 1$

Also, to express this slope as a ratio, the following formula can be used:

$$\frac{100}{\% \text{ slope}} = \text{Horizontal distance:1} \qquad \frac{100}{5.1\%} = 19.6 : 1$$

AREA

Area calculations are done routinely at landfills. Give 2 horizontal dimensions, one can determine area.

Formula: Length x Width = Area (square units)

Area calculations are often referred to as acres. One acre equals 43,560 ft^2. To determine the number of acres divide the number of square feet of the area in question by 43,560 ft^2/acre.

VOLUME

Volume measurements are also used daily in landfill operations. Volumes are reports as cubic yards.

Formula: Length x Width x Height = Volume

Example: If the average waste area of fill between two stations 100 feet apart is 23,547 ft^2, this would represent the height and width part of the formula.

The length is 100 feet because a cross section is developed for each 100 foot interval in the plans.

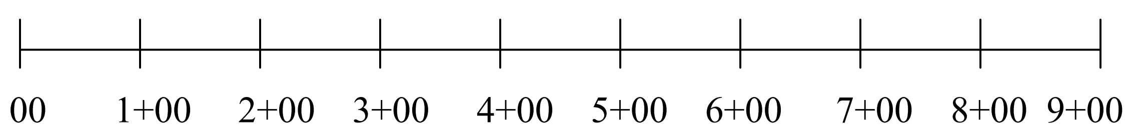
The volume is: $23{,}457\ ft^2 \times 100 \frac{ft \times 1\ yd^3}{27\ ft^3} = 87{,}211.11\ yd^3$

Factor: 1 cubic yard equals 27 cubic feet

BASELINE

A baseline is a line drawn on the site plan that is used to reference information to the drawings. The cross sections are referenced to stations on the baseline. Therefore, the baseline is the feature of your engineering drawings that ties plan views of the site to volume data.

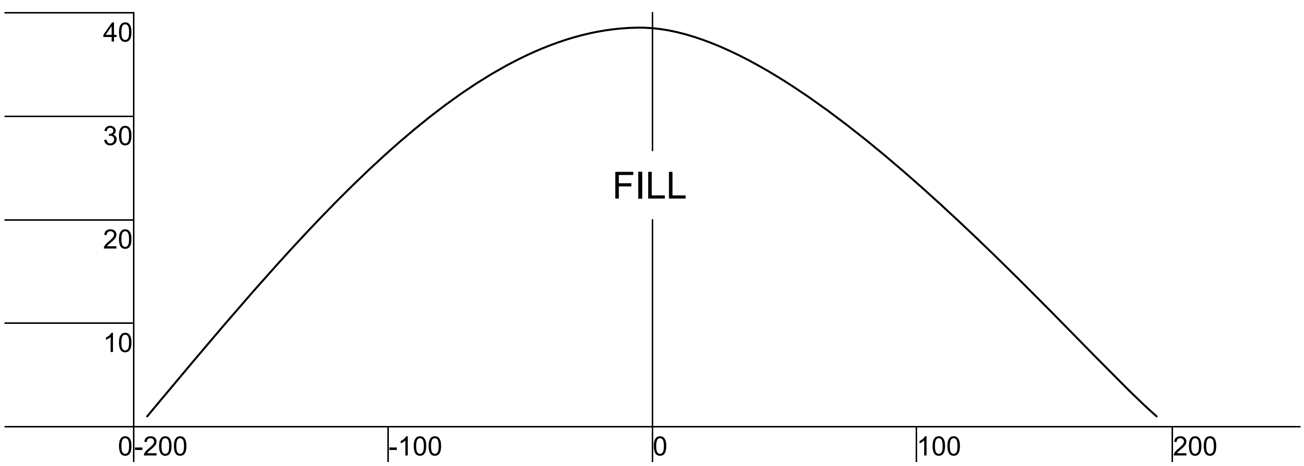
FIGURE 9-5



CROSS SECTION

The volume information for landfill plans is also contained in the cross sections. Cross sections are developed usually for each 100 feet of landfill and are keyed to a baseline on the site plan. You must be extremely careful to correctly interpret cross sections because they use two scales; one for horizontal and one for vertical measurement. Another important factor in using this data is to allow proper space for in place density waste, daily cover and final cover.

FIGURE 9-6



1 inch = 10 feet

FOLLOWING PLANS

Maintaining proper elevations is the key to following plans. To do this, existing elevations and proposed cut or fill elevations must be determined based on the plans. The following items are essential to follow plans.

- Permanent grade stakes/elevations markers are necessary to use as a reference point. These could be monuments or lag screws in a tree, utility pole or on a building. Do not use items that may be moved during construction of the fill such as fence posts, road, etc.
- Temporary grade stakes can be placed in areas where filling is occurring to obtain slopes and elevations.
- Grade must be checked against plans periodically.
- Obtaining an overall site plan elevation is best accomplished by using an <u>Operational Plan</u> to show how to achieve the final product. The site manager, operator and engineer must discuss drainage operation and traffic flow for each phase.

FIELD MEASUREMENTS

Field measurements are taken to determine compliance with plans. These measurements include elevation, distance and slope.

ELEVATION

Elevation is the vertical distance between points. Plan elevations are drawn based on sea level data or using an assumed elevation based on a fixed point on the site. The most accurate method of determining elevation is with a transit or builders level and a grade rod.

Due to the nature of landfills, more than one instrument setting may be required to obtain the necessary elevations. This is due to the restriction of visibility through the instrument to establish a reading on the rod.

Steps to determine if the slope, as built, complies with the plans

Step 1: Determine the difference in elevation between the toe and top of the slope using surveying techniques.

Step 2: Determine the horizontal distance between the two points. DO NOT measure the slope distance.

Step 3: Calculate the percent of grade or slope as discussed above.

MEASURING DISTANCE

Distance is the true horizontal measurement of the length between 2 points. It is measured using either expedient means or using tapes, wheel or distance measuring instruments.

FIGURE 9-6

Incorrect Correct

Counting paces along a distance can make expedient measurements. Multiplying the average pace length by the paces counted. To determine the average pace distance:

1. Measure a 100 foot test distance on the ground,
2. Pace the test distance 3 times,
3. Average the number of paces, and
4. Compute the average pace using the following formula.

$$\text{Average Pace} = \frac{\text{Test distance}}{\text{Number of Paces}}$$

This method is very crude and should only be used for relatively simple checks.

More accurate methods of measurement are required for determining place compliance and installing support features (liners, drainage ditches, leachate systems, etc.). These measurements are made using tape measures or other devices such as electronic distance measurement (EDM).

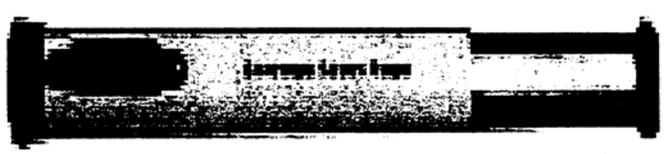
SLOPE

Slope determination using a hand level

An acceptable alternative to using a transit or builders level is use of a hand level. Hand levels are not as accurate over long distances but are cheaper to purchase and easier to use.

FIGURE 9-7

Typical Hand Level

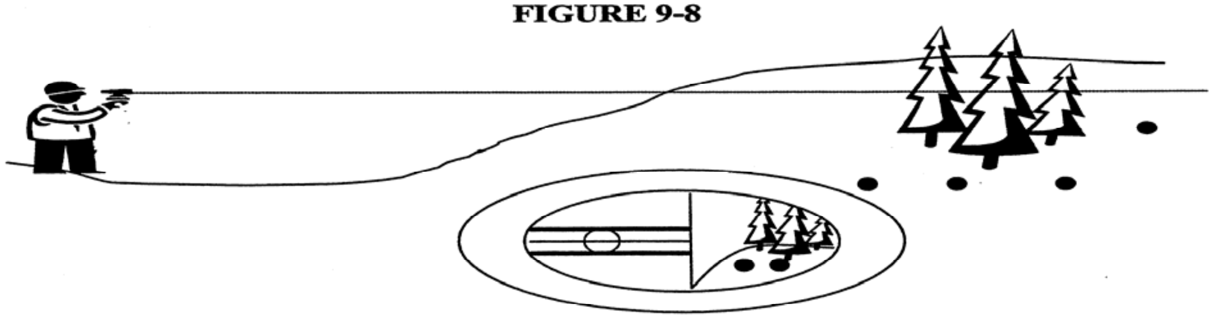


Steps to use a hand level

Step 1: Pick a stationary object or place a grade stake in the ground upgrade on the slope.
Step 2: Go down slope until the object is at eye level.
Step 3: Site through the hand level and adjust your position on the slope until bubble is centered on the base of the object.
Step 4: Measure the distance from your eyes to the ground (vertical distance) and from your position to the object (horizontal distance).

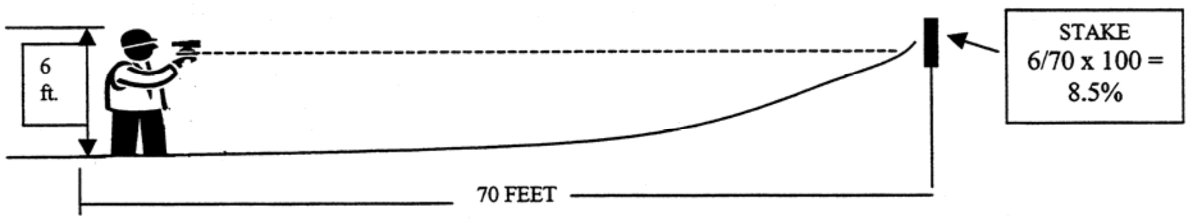
Step 5: Calculate the percent of grade of slope.

FIGURE 9-8



$$\% \text{ of grade} = \frac{\text{Height}}{\text{Distance}} \times 100$$

FIGURE 9-9



ENVIRONMENTAL MONITORING

Compliance with EPS requires, in part, that pollutants not be discharged into the water of the Commonwealth nor groundwater contaminated beyond the point of compliance for the facility in excess of the maximum contaminated limit (MCL) (401 KAR 30:031 or 401 KAR 47:030) or statistically elevated concentrations of parameters that lack MCL's. Geologic, hydrogeologic and soils data, as well as monitoring plans, are include in the permit application package for special waste, residual, construction/demolition/debris and contained landfills. The Division reviews this information to determine the potential for contamination/migration; and based on their findings, specifies (through the permit) the design of the monitoring system.

SURFACE WATER

Surface water sampling allows for verification that leachate is not entering the surface water drainage system and that the applicant holds or has applied for a Kentucky Pollutant Discharge Elimination System (KPDES) permit for all point source discharge structures. Surface water monitoring points should be located to characterize the quality of water unaffected by the landfill and water that leaves the landfill in surface drainage after storm-induced runoff has ceased. In selecting monitoring locations, one site should be identified, above the landfill or outside of the affects of waste placement, for use in background comparisons. Downgradient monitoring point(s) should be located on the inlet side of the surface water sediment structures, in the landfills surface water runoff ditches to monitor the landfill runoff water before it enters the sediment ponds. The upgradient point selected may be a surface stream.

An analysis shall be conducted for the following parameters by collecting grab samples, at previously specified points, on a quarterly basis.

Quarterly Monitoring

- Chlorides,
- Sodium,
- Sulfate,
- Total organic carbon (TOC) or biochemical oxygen demand (BOD),
- Iron,
- Specific conductance,
- pH, and
- Solids (total suspended solids, total dissolved solids and total solids) chemical oxygen demand.

All landfills with storm water runoff structures and point source discharges are required to have a KPDES from the Division of Water. Documentation will be required during the Division of Waste Management permit review process that this application has been submitted.

GROUNDWATER

The monitoring system approved within the application is meant to allow an accurate assessment of the groundwater quality and characterize groundwater flow and flow systems. This systems must include at least one background well hydraulically upgradient from the disposal area and at least 3 downgradient monitoring wells. In some case, the Division, in addition to or instead of Downgradient wells, may approve springs.

Groundwater sampling intervals and parameters differ for each type of solid or special waste site or facility. Residual landfills monitor quarterly for parameters determined by the Division based upon the chemical analysis of the waste to be disposed (401 KAR 48:300 section 11(4)).

C/D/D LANDFILLS MONITOR SEMI-ANNUALLY FOR:

Chloride	Arsenic
Chemical oxygen demand	Barium
Total dissolved solids	Cadmium
Total organic carbon	Chromium
Specific conductance	Lead
pH	Mercury
Iron	Nitrate
Sodium	Selenium
Groundwater elevations	Temperature
Other parameters specified in permit	

If after 4 consecutive monitoring periods, analysis of the required parameters indicates no exceedences of the MCL's, the owner or operator may request to reduce the monitoring parameters to those listed in 401 KAR 48:300 section 11(2)(a).

SPECIAL WASTE LANDFILLS MONITOR SEMI-ANNUALLY FOR:

Chloride	Chemical oxygen demand
Total dissolved solids	Total organic carbon
Specific conductance	pH
Copper	Groundwater elevation
Other parameters as specified by the Cabinet	

If after four initial monitoring events, analysis for the required parameters indicates no exceedences above levels the MCL's as specified in 401 KAR 30:031 or significant increases over established background levels for parameters that have no MCL, the owner or operator may request to reduce the monitoring parameters to those listed in 401 KAR 45:160 section 8(2)(a).

CONTAINED LANDFILLS MONITOR QUARTERLY FOR:

Arsenic	Silver
Antimony	Sodium
Barium	Thallium
Beryllium	Vanadium
Cadmium	Zinc
Chromium	Temperature
Cobalt	Chloride
Copper	Chemical Oxygen Demand
Iron	Total Dissolved Solids
Lead	Total Organic Carbon

Mercury	Specific Conductance
Nickel	pH
Nitrate	Total Organic Halides
Selenium	Acetone
Acrolein	Acrylonitrile
Benzene	Bromochloromethane
Bromodichloromethane	Bromoform
Bromomethane	2-Butanone
Carbon Disulfide	Carbon Tetrachloride
Chlorobenzene	Chlorodibromomethane
Chloroethane	Chloroform
Chloromethane	Dibromomethane
1,2-Dibromo-3-chloro-propane	1,2-Dibromomethane
1,2-Dichlorobenzene	1,4-Dichlorobenzene
Trans-1,4-dichloro-2-butene	1,1-Dichloroethane
1,2-Dichloroethane	cis-1,3-dichloropropene
Trans-1,3-dichloropropene	Ethylbenzene
2-Hexanone	Iodomethane
Methylene Chloride	4-Methyl-2-pentanone
1,1-Dichloroethene	Cis-1,2-dichloroethene
Trans-1,2-dichloroethene	1,2-Dichloropropane
Styrene	1,1,1,2,-Tetrachloroethane
1,1,2,2-Tetrachloroethane	Tetrachloroethylene
Toluene	1,1,1-Trichloroethane
1,1,2-Trichloroethane	Trichloroethene
Trichlorofluoromethane	1,2,3-Trichloropropane
Vinyl Acetate	Vinyl Chloride
Xylene	Groundwater Elevations
Rate and direction of groundwater flow	Other parameters specified by permit

If after 4 consecutive monitoring periods, analysis of the required parameters indicates no exceedences of the MCL's, the owner or operator may request to reduce the monitoring parameters to those listed in 401 KAR 48:300 section 11(3)(e).

The procedures used by the laboratory must be consistent with those outlined in SW-846 or other approved methods. SW-846 is a manual consisting of exact lab methods and procedures necessary to correctly analyze a sample.

Two valuable reference documents can be obtained by writing the following addresses:

Publication SW-611 "Procedures for Groundwater Monitoring at Solid Waste Disposal Facilities" December 1980

Write to: Solid Waste Information Distribution Office
U.S. EPA
Cincinnati, Ohio 45268

Groundwater Technical Enforcement Guidance Document (TEGD)

Write to: Government Printing Office
North Capital Street, N.W.
Washington, D.C. 20401
(202) 275-3648

Remember Kentucky's Solid Waste Program has Federal authorization and our statutes and regulations replaces Subtitle "D" requirements.

If a laboratory or statistical analysis indicates that an MCL or background concentration has been exceeded by one or more parameters, and this exceedence has been verified by confirmation sampling, a groundwater assessment plan must be prepared and submitted within 30 days of the occurrence. Contents of the plan and confirmation sampling procedures are outlined in 401 KAR 48:300 section 8.

DATA SUBMISSION

All lab results must be submitted, within 60 days of the sampling event or 15 days after receipt of the statistical analysis – whichever is sooner. The statistical analysis must be performed separately for each parameter in section 11, for each sampling event, and for each well to determine if there has been a significant increase over background values for each parameter that lacks an MCL. This information must be submitted in duplicate to the Solid Waste Branch, Division of Waste Management, Frankfort Office Park, 14 Reilly Rod, Frankfort, Kentucky 40601. If laboratory delays are encountered, a letter requesting an extension of the 30 day period must be sent to the Solid Waste Branch, Permit Review Section.

If sample results indicate contamination, the owner or operator must notify the Division within 48 hours of analysis receipt and arrange to split confirmation samples within 10 days of analysis receipt. The requirements for groundwater monitoring, assessment and corrective action can be illustrated by the following schedule.

GROUNDWATER MONITORING, ASSESSMENT/CORRECTIVE ACTION SCHEDULE

Day	Activity To Be Accomplished (if required)	48:300 Reference
--	Samples are obtained from well	Section 7(1)
0	Analysis received within 60 days of sampling (maximum)	Section 7(2)
2	If contamination is detected, special notice must be given to Cabinet	Section 7(3)
3	Owner or operator provides drinking water to affected parties	Section 8(3)
10	Confirmation sampling	Section 7(3)
30	Assessment monitoring plan due to Cabinet	Section 8(4)
77	Cabinet review/approval due	Section 8(4)(a)
137	60 days for owner or operator to implement assessment plan	Section 8(4)(a)
227	90 days to submit Assessment Report to the Cabinet	Section 8(7)
275	Cabinet review of Assessment Report	
365	Submit Corrective Action Plan within 90 days of Assessment Report approval, but no later than 1 year from date of original analysis	Section 8(9)

SAMPLE COLLECTION

All sanitary landfills that are required to monitor must have samples collected using proper and approved collection procedures. This cannot be over emphasized as the end goal is the collection of a representative sample(s). The following checklists are included as an aid for the landfill manager to ensure proper collection techniques are being followed.

GENERAL CONSIDERATIONS

- Always wear clean, chemically inert latex or plastic disposable gloves when taking samples. Change them each time a new sample is taken.
- Always clean the sample equipment before and after sample collection. Distilled water should be used.
- NEW sample containers must be used to collect samples.
- Use the proper types container (Teflon, glass, stainless steel or plastic) for the analysis to be conducted.
- Avoid contaminating the inside of the sample bottle when removing the cap.

- Do not place anything, except proper preservatives, into a sample container.
- Collect a sufficient volume, yet leave some air space when sampling for bacteria or suspended solids.
- Properly identify each collected sample.
- Protect collected samples by properly packing them in ice for transportation.

SURFACE WATER SAMPLING CONSIDERATIONS

- Do not sample immediately after a storm. Sample after storm induced surface runoff has ceased and runoff continues under base flow conditions.
- Prepare a location for sampling
- Place the mouth of the collection container below the water surface and facing flow. Avoid the capture of floating material.
- Keep hands away from the mouth of the jar.
- Keep the mouth of the jar above the stream bed.

GROUNDWATER SAMPLING CONSIDERATIONS

- The upgradient (background) well must always be sampled first.
- Provide a clean working surface at each well by placing a large sheet of plastic or aluminum foil around the well. After each use, dispose of all plastic, etc.
- The depth of water should be measured with a freshly cleaned instrument each time. Always BEFORE removal of water from the well.
- NEW plastic disposable gloves should be worn and changed between sampling of each well.
- The proper amount (3 well volumes) of water should be removed for each well BEFORE collecting a sample; or, micropurge stabilization parameters must have stabilized according to approved procedures.
- The bailer should ALWAYS be lowered slowing into a well to prevent disturbance of the water and to prevent the sample from becoming murky.
- All wells should be locked and inner casings should always have protective caps to prevent foreign matter from entering the well. Wells should also be protected with steel or concrete posts and clearly marked and labeled with appropriate well numbers (AKGWA). These well numbers (AKGWA) are those that are assigned by the Groundwater Branch, Division of Water.

*REMEMBER – Assume ANYTHING inserted into a monitoring well could be DIRTY, can easily AFFECT your final result, and can ruin the well for future monitoring.

TESTING FOR EXPLOSIVE GASES

In order to properly conduct testing for explosive gases the following equipment will be necessary:

1. Explosive gas detector
2. Weighted, insulated, bar hole punch

The explosive gas meter should read “percent explosive” and should have a flexible probe capable of being placed in subsurface holes made by the bar hole punch.

Contained landfills must not exceed:

- 25 percent of the LEL for methane in facility structures (excluding gas control or recovery system components)
- the LEL for methane at property boundary

Gas detector alarms, set at 25 percent LEL, must be installed and maintained in each facility structure. If methane gas levels are found to exceed the limits referenced above, the owner or operator must:

- take all steps necessary to ensure immediate protection of human health,
- immediately notify the Division of the exceedence and remedial measures, and
- within 14 days, submit a remediation plan detailing the nature and extent of the problem and proposed remedy.

Managers should observe testing procedures or conduct the tests themselves according to the guidelines below.

SUBSURFACE TESTING

Holes should be advanced into the ground by the bar hole punch, approximately 3 to 4 feet deep. The explosimeter probe should be carefully placed into the top 6 inches of the hole immediately after removing the hole punch. DO

NOT allow soil or water (or other objects) to be drawn into the probe. This may damage or ruin the gas detector.

After inserting the probe, several volumes of air should be drawn into the gas meter while cautiously observing the needle. After obtaining the reading, remove the probe and clear the gas meter by allowing ambient air (air you breathe) to flow through the probe and detector until a reading of "0" is obtained. Seal the hole properly when finished.

SURFACE TESTING

This method consists of placing the probe in areas in and around the landfill vicinity and simply drawing a sufficient amount of air to obtain a reading.

Test Locations

The sampling stations or locations will, at times be dynamic, but for the most part, certain areas should be tested at each round of testing. Underneath or at the lowest point of all buildings, basements, structures, manholes, pipes, etc., must be regularly tested. Set locations along the boundary, gas venting pipes and gas problem areas must also be monitored. Adjacent structures off site and off the property boundary should also be tested. The subsurface near all structures should be tested. Both surface and subsurface testing at the facility boundary should take place. Small, brightly colored surveyor flags are recommended to mark test stations for future sampling events.

Frequency

Explosive gas testing should be conducted on a monthly basis through the spring (after the last freeze), summer and fall months (until the first freeze). Weekly testing programs should be conducted in the winter months. It may be appropriate to increase the frequency, depending on severity of the gas potential and other site specific conditions. The reason for more frequent testing during colder weather is that frozen soils will tend to retain gases within the landfill (actually seal the site) and allow potentially explosive conditions to develop. Quarterly monitoring is required by regulation and detailed later in the section.

Weather Conditions

Exact weather conditions can affect explosive gas migration potential and should always be considered BEFORE beginning gas testing activities. The following conditions are optimal (the best) for testing:

- Just after a low pressure (thunderstorm or storm in general) has passed through the vicinity of the site. The low pressure will allow gases to escape more readily than high pressure.
- During time of extended freezing temperatures, the gases will not escape as easily. Potentially dangerous levels and quantities of gases can build up during cold weather.

RECORDKEEPING REQUIREMENTS

Solid waste regulations outline information to be provided as part of the technical application for all solid waste sites or facilities. This regulation (401 KAR 47:190 section 8) specifies that a recordkeeping and reporting system must be established to document:

- Construction activities,
- Monthly quantity of waste received from each source,
- Compliance with soil cover requirements,
- Environmental monitoring (surface water, ground water, methane, etc.),
- Random inspections of incoming waste,
- Quantity and concentration of leachate removed,
- For contained landfills, spill residues and limited quantity generator wastes received, and
- Remaining landfill volume.

<u>DOCUMENTATION OF CONSTRUCTION REQUIREMENTS</u>

Each new landfill or existing sites applying for an expansion will be required to document the construction of:

- Liners,
- Hydrologic systems (e.g., surface water drainage devices and ground water well installation), and
- Leachate collection system.

The owner's qualified representative, ensuring that the facility was constructed in accordance with approved plans immediately upon completion, must submit a certification report.

Construction records are to be maintained onsite as a permanent record. The quarterly report for that reporting period should, at a minimum, show the construction completed to date as specified in the approved application. In the event the quarter ends and construction is incomplete, the quarterly record should, at a minimum, reflect the percentage of construction completed. The number of ground water or surface water monitoring wells installed should be shown, by well number, as identified in the approved site engineering plans.

WASTE QUANTITY RECORDS

Sanitary landfills must have a system for documenting the amount of waste received at the facility on a monthly basis. The intent behind the collection of this data is to document the amount of waste being disposed of at sanitary landfills in the state. This information benefits local and state officials, as well as the landfill owner, who are charged with planning for and management of the solid waste stream.

SOIL COVER

Cover requirements exist for daily, interim, long term and final cover (see Operating Your Landfill section of this manual). Compliance with the requirements, specified in 401 KAR 48:170, 48:060, 48:070 and 48:080 relative to the specific type facility being designed, must be documented. This documentation shall be maintained onsite as a reference document for use by operators, managers, inspectors and in compiling quarterly reports.

ENVIRONMENTAL MONITORING

As discussed earlier in this section, environmental monitoring must occur to determine the presence of methane gas and the quality of surface and ground water sources in the area. Monitoring results are to be submitted as part of the quarterly report. Samples and measurements taken must be representative of the monitored activity. All monitoring information, records filed and all data utilized to compile these reports, must be maintained for a 3 year period. The monitoring information referred to above includes:

- Date, exact location and time of sample,
- Name of person who performed the sample,
- Date of analysis,
- Name of person who performed analysis,
- Analytical technique or methods used, and
- Results of the analysis.

Regulations (401 KAR 48:090) specify the exact locations to monitor for explosive gases which are:

- Underneath or in lowest point of each onsite building,
- Locations along the boundary as determined by the permit,
- At each passive gas vent installed under final closure,
- Any potential gas problem areas (i.e., dead vegetation), and
- Other points identified in the permit.

In addition, records from all groundwater monitoring wells and associated ground water surface elevations must be maintained for the active life of the facility and closure care period.

SCREENING INCOMING WASTE

The owner or operator of a contained landfill must implement a program designed to prevent the disposal of regulated hazardous waste as defined in 401 KAR chapter 31 and polychlorinated bipheyls (PCB) wastes as defined in 40 CFR part 761. The requirements for this program can be found in 401 KAR 48:090 section 2 and should be included in the approved permit application. This program includes:

- Random inspections of incoming waste,
- Inspections of suspicious loads,
- Records of inspections,
- Training of facility personnel to recognize regulated hazardous waste,
- Procedures for notifying the proper authorities if a regulated hazardous waste is discovered at the facility, and
- Employee safety, health, training and equipment to be used in the inspections.

LEACHATE

The facility must document the quantity and concentration of leachate removed from the site, disposal location, and method of disposal. The concentration must be determined by utilizing the appropriate parameters specified in 401 KAR 48:300.

ADDITIONAL REPORTING REQUIREMENTS

Contained landfills must weigh all waste entering the landfill for disposal and must keep records on the source (county and state of origination) and quantity (in tons) of all wastes received. Disposal locations must also be recorded for all spill residues and limited quantity generator wastes received.

QUARTERLY DATA SUBMISSION

401 KAR 47:190 section 8 requires quarterly reports be submitted to the Division of Waste Management to document compliance with specified recordkeeping requirements. Information supporting these quarterly reports shall be maintained onsite for at least three years for review by the regional inspector. Reports are to be submitted on forms approved by the Division on the following schedule: first quarter reports cover the months of January, February and March – reports due April 15. Second quarter reports cover the months of April, May and June – reports due July 15. Third quarter reports cover the months of July, August and September – reports due October 15. Fourth quarter reports cover the months of October, November and December – reports due January 15.

ANNUAL VOLUME SURVEY

All solid waste landfills must conduct an annual survey to determine remaining landfill volume, which may be used for waste disposal. The quantity of waste disposed per day shall be determined by dividing the total waste received in one year by 365 calendar days. This survey must bear the seal and signature of the engineer or land surveyor who conducted the survey on each page of the drawings. The owner or operator shall notify the Cabinet no less than 15 calendar days prior to the date the survey will be conducted. The annual survey must be made between January 1 and May 1 and should include the following:

- Cross sections on 100 ft intervals which show present waste disposal,
- Waste elevations and final contours, and
- Remaining available capacity in cubic yards.

This information must be submitted to the Division within 60 days of a walking survey or within 90 days if aerial photography is used on a form provided by the Division.

NOTE: The Division will furnish you copies of the aforementioned forms. When you receive your copy, please make copies for future use. Due to limited manpower and time constraints, we are unable to send these forms out each reporting period.

STUDY GUIDE
MONITORING YOUR LANDFILL

1. _____________ is a process of collecting information, comparing the information to permit documents and determining compliance.

2. The plan scale is the _________________ between measurements on the plan and measurements on the ground.

3. The formula to determine distance in feet on a plan scale is:

   ____

   ____

   ____

4. Contour lines are:

   ____

   ____

   ____

   ____

5. Plan views use ___________ to show changes in elevation. The formula to change elevation is:

   ____

6. Slope, used to express steepness of grade, may be used as a ratio or a percent. When used as a ratio, the first number indicates the _______________ and the second number indicates the ______________ in _____________.

7. To determine the percent of slope, one must divide the ___________ ____________ by the ____________ ______________ and multiply the result by 100.

8. Given two horizontal dimensions, one can determine area. Give the formula to determine the area:

____

9. Volume units are reported as __________ ____________.

10. Give the formula for determining volume:

____

11. A baseline is a line drawn on the site plan that is used to __________ information to the drawings.

12. Cross sections use two scales, one for ______________ and one for _________________ measurement.

13. Cross sections are developed usually for each _____ feet of landfill and are keyed to a baseline on the site plan.

14. Maintaining __________ __________ is the key to following plans. To do this, ________________ __________ and ___________ ______ **OR** ______ __________ must be determined based on the plans. The following items are essential to follow plans:

____

____

____

____

15. Field measurement plans are taken to determine compliance with plans. These include:

____

____

____

____

____

16. Elevation is the ___________ distance between points; the most accurate method of determining elevation is with a ____________ or _____________ ___________ and a grade rod.

17. List steps necessary to determine if the slope, as built, complies with the plans:

STEP 1:

____

____

____

____

____

STEP 2:

____

____

____

____

STEP 3:

18. Distance is the true _______ measurement of the length between two (2) points on a long baseline.

19. List the steps and formula to determine distance by pacing:

20. List steps and formula to determine slope using a hand level:

STEP 1

STEP 2:

STEP 3:

STEP 4:

STEP 5:

21. A complete quarterly report contains all of the following information:

____

____

____

____

____

22. Surface water sampling allows for verification that leachate is not entering the surface water drainage system and that the applicant holds or has applied for a

____________ ____________ _____________ ______________ _______________
(__________) __________ for all point source discharge structures.

23. Surface water monitoring plans must include:

____

____

____

____

____

24. Groundwater monitoring plans must include:

____

____

____

____

____

25. When sampling groundwater, the _________ _________ must always be sampled first.

26. ____ well volumes of water should be removed from each well ___________ collecting a sample of groundwater or micropurge _______________ ___________ must have _______________ _________________________.

27. ____________ is an U.S. EPA manual consisting of exact lab methods and procedures necessary to correctly analyze a sample.

28. Contained landfills must not exceed ___ percent of the lower explosive limits for methane in facility structures.

29. Frequency of methane gas monitoring is dependent on the weather. Name the season(s) for monthly testing and the season(s) for weekly testing:

____

____

____

30. An annual survey is used to determine remaining landfill volume. This survey must include:

____

____

____

____

____

Be made between __________________ and _______________;
Be submitted to the Division within ____________ of a walking survey or within _______________ if aerial photography is used

CHAPTER 10
LANDFILL SAFETY

This section discusses the benefits of safety, outlines safety procedures and describes how to establish a safety program.

IMPORTANCE OF SAFE OPERATIONS

Safe operation of a landfill is only possible with the complete cooperation of all personnel participating in the operation. This cooperation can only be achieved if there is a mutual trust and respect between members of management and labor. Concern for the welfare of all employees must be evident to maintain a safe workplace. A safe workplace does not mean a workplace free of all risks. It does mean a workplace where every attempt is made, by all involved, to recognize and minimize hazards; and train each employee in the proper procedures to manage those hazards.

National Safety Council statistics indicate that injury rates for refuse disposal operations are 14 times the national average for other industries. No data has been presented for landfill operations, but the nature of the work being conducted at a facility presents a special risk to the employees and customers using the facility. Most accidents and resulting injuries are preventable. More than 80 percent of all accidents are caused by unsafe acts. Unsafe conditions or "acts of God" cause the rest. All accidents, except "acts of God", are preventable.

Landfill operations involve certain risks because of the potential for encounters with heavy equipment used in processing, transportation hazards during collection, foreign materials contained in raw materials, vectors, pathogens, noise, dust, fire, etc. Landfill activities involve risks however; those risks do not need to be unreasonable. Fairness to workers requires that a thorough understanding of the risks and hazards present on the job are conveyed to them and that those workers receive training to deal with potential hazards.

Even if issues of fairness and justice were ignored, the economic impacts of unsafe operations cannot be ignored. The direct cost of treatment for injuries or disabilities, employee death, equipment and facility damage, increased insurance costs, as well as damage to workers morale and productivity will negatively affect the success of the operation. The effects of accidents and unprotected exposure to occupational hazards can and will overwhelm operational budgets.

In addition to fairness and economic concerns, safety on the worksite is mandated by U.S. Occupation Safety and Health Administration (OSHA) regulations. The Kentucky Occupations Safety and Health Review Commission adopted the regulations contained in 29 CFR part 1910 and Health Standards Board as 803 KAR 2:300 through 2:320. OSHA regulations require employers to make employees aware of hazards they face in the workplace. Additionally, they must be trained to respond to those hazards in a safe manner. While it is not in the scope of this manual to address all regulatory requirements, we will consider some of the basics.

BENEFITS OF SAFE OPERATIONS

Safe operations benefit the landfill owner, manager and operator. Benefits to the owner and manager of the landfill include:

- Workers are on the job, not the injury list,
- Morale is higher due to a safe working environment,
- Accident insurance may cost less,
- Equipments will last longer with less repair, and
- Benefits to the operator include:
    - ✓ Avoid pain and possible permanent injury,
    - ✓ No loss of wages or job security,
    - ✓ Better chance for promotions and transfers, and
    - ✓ Morale is high as free time can be enjoyed more fully.

Remember: Your best protection against injury is your own attitude.

LANDFILL OPERATION SAFETY PROGRAMS

Safety training programs cover more than just holding safety meetings. These programs must also be used to identify hazards at your facility. All personnel must be trained to look for unsafe conditions or actions and informed of the correct procedure to report them so they can be corrected. Evaluating hazards encountered in the normal workday, developing procedures to reduce those hazards and implementing procedures through a comprehensive safety program can help in the development of the landfill operation safety program. Some examples would include:

- Commonly encountered hazards that the public accepts such as auto safety, use of appliances and small equipment, and “acts of God”.
- Hazards commonly encountered and accepted by trained workers (trucks, tractors, compactors, earth moving equipment and power tools).
- Unusual hazards that do not fall in those listed above such as chemical, radiological and biological hazards.

- Workers are often the only ones who are aware of the existence of these hazards.

RISK ASSESSMENT

- You should assess and prioritize existing hazards.
- Identify all adverse effects of those hazards.
- If an accident happens, what are the results?
- Evaluate conditions of exposure and affects.
- Under what situations could the hazard occur?
- Assess the degree of harm from a given affect/exposure. The effect to the person, if the hazard happens, divided by the number of exposures in a period time.
- Develop control methods and procedures that minimize the harm to employees and the public.

PROGRAM MONITORING

- Monitor and update your program as needed.
- Check to see if control methods and procedures are working for known hazards.
- Set up a system to check for potential new hazards.
- Develop new control methods and procedures when new activities are undertaken at the landfill.
- Hold regular meetings to discuss causes and methods of preventing accidents.

REPORTING PROCEDURES

All personnel at the site must know the procedures for reporting accidents, injuries, fires and other unusual occurrences. Procedures should be posted by the phone and in the safety program documentation. Listed items should include:

- Telephone number for ambulance, doctor, hospital, fire department, law enforcement and Poison Control Center,
- Location of nearest medical support, bloodborne pathogens and first aid kits, and
- Incident reporting instructions.

RECORDS

Accurate records are very important to comply with state and federal safety regulations and to maintain an incentive program to help reduce accidents. In addition, records will provide an indication of the effectiveness of the safety program. A sample accident report form is provided in appendix D.

LANDFILL HAZARDS

We can generally divide associated hazards into three broad categories. These are chemical, physical and biological. We will examine each of these categories in the following.

CHEMICAL SAFETY

EMPLOYEE RIGHT TO KNOW (29 CFR 1910.1200)

The first step in developing a safety program is to identify all chemical hazards and to ensure that all employees are informed. This means that employees have the right to know the identity of all hazardous chemicals they will encounter in the workplace, understand the health effects of exposure and know and understand how to work safely with those materials. This information must be provided in writing. Generally, there are not a great number of different hazardous chemicals or materials on a landfill site. However, a survey and inventory should be conducted to assure the proper Material Safety Data Sheets (MSDS) are available.

The Employee Right to Know Program must include the following elements.

- All hazardous materials in the workplace must be identified; including those that might be present in confined spaces,
- MSDS on all identified hazardous chemicals must be prepared and placed in a notebook accessible to all employees at the site,
- Employees must be trained on the requirements of Right to Know legislation, content and purpose of MSDS and how to access all information related to the workplace,
- All containers at the work site must be appropriately labeled to describe contents and have appropriate hazard warnings, and
- Employees must be trained in how to handle and manage the hazards to which they could be exposed.

MATERIAL SAFETY DATA SHEET (29 CFR 1910.1200)

Material Safety Data Sheets shall be in English, available for all hazardous materials onsite and shall contain the following information:

- The chemical manufacturer's name, address, emergency telephone number, the chemical name, trade name and chemical formula,
- The physical and chemical characteristics of the hazardous chemical (such as vapor pressure, flash point),
- The physical hazards of the hazardous chemical, including the potential for fire, explosion and reactivity,
- The health hazards of the hazardous chemical, including signs and symptoms of exposure and any medical conditions which are generally recognized as being aggravated by exposure to the chemical,
- The primary route(s) of entry,
- The OSHA permissible exposure limit (PEL), ACGIH Threshold Limit Value (TLV) and any other exposure limit used or recommended by the chemical manufacturer, importer or employer preparing the MSDS, where available,
- Whether the hazardous chemical is listed in the National Toxicology Program (NTP) Annual Report on Carcinogens (latest edition), or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition), or by OSHA,
- Any generally applicable precautions for safe handling and use which are known to the chemical manufacturer, importer or employer preparing the MSDS, including appropriate hygienic practices, protective measure during repair and maintenance of contaminated equipment and procedures for clean up of spills and leaks,
- Any generally applicable control measures that are known to the chemical manufacturer, importer or employer preparing the MSDS, such as appropriate engineering controls, work practices or personal protecting equipment.
- Emergency and first aid procedures, and
- The date of preparation of MSDS or date of last change made.

PROTECTION FROM CHEMICAL HAZARDS

Once information on the chemical hazard has been obtained, the employer and employee can select the proper personal protective equipment (PPE). Hazardous materials may enter the body by inhalation (most common), ingestion, absorption through the skin and eyes or injection. The primary ways workers are exposed to hazardous chemical include:

- Failure to follow proper procedures or to use appropriate PPE,
- Inadequate knowledge of the materials,
- Failure to decontaminate oneself or equipment, or
- Careless: unprotected contact with hazardous materials such as walking through puddles or into clouds of unknown vapors, consuming food, water or smoking cigarettes contaminated by contact with gloves, equipment or unwashed hands.

PHYSICAL HAZARDS

Physical hazards abound at landfill operations from the exposure to large equipment, electrical hazards and confined spaces as well as many relatively minor injuries such as cuts, strains, sprains, bruises and abrasions. These injuries occur because of slips and falls, improper lifting, incautious backing of equipment, improper confined space entry, failure to properly lockout and Tagout energy sources, and improper use of hand or power tools. While the majority of injuries are generally minor, serious injuries or deaths may result. Prolonged exposure to loud noises may permanently damage hearing. Failure to lock and tag energy sources and improper confined space entry may result in fatalities. Exposure to heat and cold may cause heat stroke or frost bite and can lead to indirect effects such as fatigue, dizziness and confusion which in turn can lead to accidents, injuries and death. General guidelines for protection from physical hazards include:

- Use PPE such as hearing protection, hardhats, steel toe boots, safety glasses and gloves,
- Maintain equipment in safe working conditions: perform regular preventive maintenance on heavy equipment, replace frayed electrical cords on hand tools, replace broken handles on shovels, rakes, hammers, etc.,
- Keep guards properly adjusted and in place on rotating and moving equipment such as power takeoffs,
- Practice good housekeeping by keeping the work area clean and free of debris and excess water, and
- Always perform lockout/Tagout and confined space entry procedures in accordance with written standard operating procedures. Shortcuts can result in death.

EQUIPMENT OPERATION

Every equipment operator should receive thorough instruction on safe use of equipment. The following guidelines should be followed for operation equipment:

- Equipment should be checked for defects before starting. Do not start or operate defective equipment.
- Walk around the machine and look for people and other equipment before moving equipment.
- Ensure backup warning signals are operating correctly.
- Use step points and handholds when climbing on equipment. Do not risk falling off.
- Keep step points free of grease, oil and loose objects. Do not increase risk.
- Always use seat belts and remain seated when operating equipment. Keep it under control.
- All equipment should have roll over protection and fire extinguishers.
- Never get on or off moving equipment. A fall could throw you under the equipment.
- Keep equipment blades or buckets low while moving. Don’t risk a collision due to obstructed vision.
- Always look around work area to locate persons and/or other equipment. Many users at landfill sites are not familiar with the dangers of heavy equipment. People have been hit and/or killed on landfill sites.
- Carry authorized passengers only. Do not risk having passengers fall off.
- Never push a waste pile until you are sure no one is behind it.
- Be careful when pushing waste piles so that falling objects do not strike other equipment or persons.
- Operate up and down slopes. Do not run the risk of rolling over by traveling across the side slope.
- Do not speed. Equipment is harder to handle at fast speeds. High speed accidents can throw the operator or damage equipment.
- Move slowly over bulky items to prevent tipping. Try to approach bulky items from an angle.
- Do not crush sealed or unknown containers. Check contents to prevent possible fires or explosions. If you are unsure of the contents, have the containers returned or set aside and call local or state authorities.
- Park equipment on level ground with blade or bucket firmly on the ground.

- Do not leave unattended equipment running. Someone may try to operate or accidentally engage the equipment.
- Do not operate equipment in the dark without adequate lighting.
- Have an experienced drive on the equipment if it is necessary to work on it with the engine running.

OPERATOR PROTECTIVE EQUIPMENT

The following protective equipment should be available and used by the operator to prevent injury:

- Ear protection will reduce the potential of hearing loss from excessive noise.
- Hard hats protect you from collision with stationary, falling and flying objects.
- Safety shoes should be worn to protect feet from crushing and puncture hazards. These shoes should have non-slip soles to reduce slipping on oily or icy surfaces. Boots with tops six inches or higher provide better protection.
- Safety goggles protect eyes from dust, flying objects and chemical contact.
- Gloves are needed to protect hands from sharp objects and chemical exposure.
- Long-sleeved shirts and trousers help protect you from exposure to sunlight, dust, liquids, chemicals, insects and flying objects.
- Wearing a fluorescent vest will make you more visible to others around you.
- Wear respirators for dusty operations (asbestos, fiberglass, ashes, etc.).

BIOLOGICAL HAZARDS

Exposure to biological hazards at a landfill is always a possibility. Appropriate precautions must be taken. While a landfill may seem, at first glance, free from the possibility of exposure, this may not be the case. Close examination reveals materials such as glass, metals, used needles and other sharp objects that may offer a significant risk of puncture to the skin, thus introducing pathogenic organisms into the body. These organisms may arise from human or animal sources that have contaminated the waste. Wastewater plant sludge that has not undergone a Process to Significantly Reduce Pathogens (PSRP) or Process to Further Reduce Pathogens (PRFP) represents an additional risk as the materials are of direct human origin and very likely to contain pathogenic organisms in high concentrations.

Additionally, the process of landfilling may encourage the growth of a number of molds and fungus that act as allergens. There is also the possibility of exposure to bloodborne pathogens, from materials in the waste stream, which can injure personnel if proper precautions are not followed.

It's important for all employees to be aware of the possibility of exposure and know the steps they must take to reduce risk factors. As with the risk from chemical and physical hazards, selection of the proper PPE and personal hygiene will greatly reduce the risk of biological exposure. General guidelines for protection from biological hazards include:

- Avoid direct contact with suspect materials.
- Wear latex or vinyl gloves, under work gloves, when in immediate contact with suspect materials.
- Train all personnel in bloodborne pathogen protection.
- Use proper respiratory protection for personnel exposed to dust and debris in the processing of materials.
- Employees must have access to hand washing, shower and toilet facilities.
- Personal hygiene should always be top priority.
- A landfill can accept many different types of wastes, some of which may present adverse health risks. Therefore, it is very important for the operator to be extremely cautious and avoid person contact with the waste.

FIRE SAFETY

Equipment and buildings are required to have proper fire extinguishers that are checked regularly and serviced as needed. Employees must be trained in the proper use of fire extinguishers. Different types (classes) of fires require different types of fire extinguishers. The following is a list of the types (classes) of fires:

- Class A Fires – occurring in wood, clothing, paper, rags and other solid materials.
- Class B Fires – occurring in flammable liquids, such as gasoline, fuel, oil, lube oil grease, some solvents, paints, etc. The materials needed to extinguish type B fires are those that dilute or eliminate the air by blanketing the surface of the fire to create a smothering effect.

- Class C Fires – occurring in electrical equipment and facilities. The extinguishing agent for this type of fire must be non-conductive of electricity and provide a smothering effect.
- Class D Fires – occurring from the chemical reaction of metal compounds such as aluminum, magnesium, phosphorous, etc.

FIRST AID

At least one person at the site should have a first aid certificate. Contact the nearest Red Cross Chapter or education facility to receive information on the first aid course(s) offered. Approximately 8 hours of training is needed for the certificate. First aid kits should be readily available to everyone at the site. These kits should include:

- Sterile gauze pads,
- Rolls of gauze bandage,
- Band-aids – both regular and non-stick,
- Adhesive tape,
- Bandage scissors,
- Sterile cotton balls,
- Roll of sterile absorbent cotton,
- Safety razors,
- Triangular bandages,
- Mouth gag,
- Safety pins,
- Cotton-tipped applicators,
- Tweezers,
- Plastic measuring cup,
- Ampoules of spirits of ammonia (vaporole-aromatic ammonia),
- Aspirin tablets or other analgesics,
- Hydrogen peroxide,
- Antibiotic ointment,
- Soap – plain white,
- Blankets and pillows,
- Activated charcoal tablets,
- One bottle syrup of Ipecac (stimulates vomiting in poisoning cases), and
- Bloodborne pathogen response kit.

CONFINED SPACE ENTRY

ALWAYS COMPLY WITH THE REGULATIONS SET FORTH IN THE CODE OF FEDERAL REGISTRY (CFR) 29 CFR 1910.146 and KENTUCKY'S OCCUPATIONAL SAFETY AND HEALTH STANDARDS FOR GENERAL INDUSTRY.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor develops and enforces comprehensive work practices and safety standards to protect American workers.

The "General Duty Clause [5(a)(1)]" of the 1972 OSHA establishes basic requirements employers must follow to provide their employees with a workplace free from recognized hazards.

CONFINED SPACE ENTRY

OSHA has identified over 238,000 workplaces with confined spaces. There are approximately 12.2 million workers employed at these facilities of which 1.6 million workers enter 4.8 million permit required confined spaces each year. Confined spaces are generally entered infrequently for cleaning, inspection and repair. Ships, aircraft and storage tanks are considered confined spaces during construction. What is a confined space? It is large enough an area and so configured that an employee can enter bodily and perform work; has limited or restricted means of entry or exit and is not designed for continuous human occupancy.

OSHA FINDING

It's estimated that there will be 63 deaths and close to 13,000 injuries this year as a result of confined spaces. There are approximately 1.6 million workers who are at risk from entering one of 4.6 million confined spaces in U.S. workplaces. However, OSHA also estimates that compliance with the permit required confined space standard could reduce fatalities, injuries and illnesses by 85 percent.

OSHA estimates that 80 to 90 percent of accidents in confined spaces could be avoided. On a yearly basis this means that 54 fatalities, 5,041 lost workday cases and 5,908 non-lost workday cases could be prevented. Compliance with safety standards will prevent nearly all work related confined space accidents and prevent additional injury and death to rescuers responding during emergencies.

Examples Of Confined Spaces

Tanks	Manholes	Boilers	Furnaces
Sewers	Silos	Hoppers	Vaults
Pipes	Trenches	Tunnels	Ducts
Bins	Pits		

CONFINED SPACE HAZARDS

Many potential hazards can be found in confined spaces. These include any condition, which poses an immediate threat to the health or life of an entrant, would cause irreversible adverse health effects or would interfere with an individual's ability to escape unaided from a permit space. Some of these hazards include:

- Oxygen deficiency - $<19.5\%$ or $>23.5\%$ oxygen concentration,
- **IDLH (Immediately Dangerous to Life or Health) atmospheres,**
- Combustibles:
  - ✓ Methane,
  - ✓ Hydrogen,
  - ✓ Acetylene,
  - ✓ Propane, and
  - ✓ Gasoline fumes.
- Toxic materials:
  - ✓ Carbon monoxide,
  - ✓ Hydrogen sulfide,
  - ✓ Welding fumes, and
  - ✓ Corrosives.
- Electricity, and
- Mechanical hazards:
  - ✓ Mixers, and
  - ✓ Crushers.

DEFINITIONS:

Entry

Entry is the act by which a person intentionally passes through an opening into a permit required confined space. Entry occurs when any part of the body passes through the opening.

Entrant

The entrant is the employee who will physically enter the confined space to perform work.

Attendant

The employee who remains outside the confined space and monitors the entrant(s); guards the space against unauthorized entry; warns the entrants of any unusual conditions and summons rescue personnel, if needed.

Permit Required Confined Space

A permit required confined space is a confined space that has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere,
- Contains a material that has the potential for engulfing an entrant, or
- Has an internal configuration such that an entrant could become trapped or asphyxiated or contains any other serious safety or health hazard.

Entry Supervisor

The entry supervisor is the employee responsible for coordinating the entry into the confined space. This must be a team leader or foreman.

Responsible Person

The responsible person is the person directly responsible for the work being performed in the confined space. This can be the team leader, foreman, journeyman or other person qualified by training and experience.

Non-Permit Required Confined Space

A confined space that does not contain or, with respect to atmospheric hazards have the potential to contain any hazard capable of causing death or serious physical harm.

Two Options for Entering Confined Spaces:

- Permit required confined space entry:
  - ✓ For hazardous or potentially hazardous confined space work.
- Non-permit confined space entry:
  - ✓ For non-hazardous confined space work.

Permit Required Confined Space Entry Procedure:

- Isolate the space from all hazards,
- Close valves:
  - ✓ Double block and bleed, or
  - ✓ Blank flange.
- Empty the space:
  - ✓ Depressurize, vent and drain.
- Lockout and Tagout equipment:
  - ✓ Electrical sources,
  - ✓ Rotating/reciprocating parts, and
  - ✓ Hazardous materials.
- Clean residue from the space, and
- Ventilate the space:
  - ✓ Use mechanical ventilation such as:
    - o Fans, and
    - o Air horns.
  - ✓ Ventilate at the rate of at least four volumes per hour,
  - ✓ Larger spaces require more ventilation,
  - ✓ Make sure air supply is not contaminated, and
  - ✓ Ventilation air supply must be from fresh air uncontaminated with flammables, toxins, etc.

Conduct a Tailboard Briefing

- Entire crew must attend this includes:
  - ✓ Attendants,
  - ✓ Entrants, and
  - ✓ Entry supervisor.
- Review hazards of entry and work,
- Review PPE,
- Review procedure for contacting rescue: and
  - ✓ Verify rescue available.
- Complete permit.

Complete Entry Permit Form:

- Permit must be correctly and completely filled out prior to entry,
- Permit must be activated by entry supervisor's signature to be valid,
- No entry is allowed without a valid permit,
- Permits are valid for up to 12 hours,
- When work is completed, permit and tailboard form should be returned to safe, and
- Cancelled permits must be kept on file for at least one year.

Test the Atmosphere:

- Check for oxygen content:
  - ✓ At least 19.5% and less than 23.5%
- Check for combustibles: and
  - ✓ Less than 10% LEL
- Check for toxic gases:
  - ✓ Most commonly carbon monoxide (PEL <35ppm), and
  - ✓ Or any other hazardous materials as determined by the use of the space.

Notice: If any time a limit is exceeded for any reason, all personnel shall immediately exit the space. No one else shall enter until atmospheric conditions are returned to safe levels.

Atmosphere Testing shall be Performed:

- Prior to every entry when the space is vacant,
- After a 10 minute ventilation period (if ventilation is necessary),
- At least hourly for permit required confined spaces, or
- More frequently, if conditions or suspicions warrant.

Enter the Space and Proceed with Work:

- An attendant shall be posted near the entrance for the duration of the work. He shall be in constant communication with the entrants while the job is in progress,
- All entrants shall sign the sign-in log when entering the space and sign out when exiting, and
- The attendant shall maintain the permit and sign-in log for the duration of the week.

When the Job is Done:

- Remove all personnel, tools and debris from the space. Sign-off the log,
- Close the space,
- Cancel the permit, and
- Review the job with the host employer (hazards, problems, other employers, etc.).

Non-Permit Confined Space Entry:

- Isolate the space,
- Ventilate the space,
- Evaluate the space,
- Test atmosphere,
- Assure justification conditions are met,
- Conduct tailboard, and
- Enter the space.

Isolate the Space from All Hazards:

- Close valves:
    - ✓ Double block and bleed, or
    - ✓ Blank flange.
- Empty the space:
    - ✓ Depressurize, vent and drain.
- Lockout and Tagout equipment: and
    - ✓ Electrical sources,
    - ✓ Rotating/reciprocating parts, and
    - ✓ Hazardous materials.
- Clean residue from the space.

Ventilate the Space:

- Use mechanical ventilation:
    - ✓ Fans, and
    - ✓ Air horns.
- Ventilate at the rate of at least four volumes per hour: and
    - ✓ Larger spaces require more ventilation.
- Make sure air supply is not contaminated:

- ✓ Ventilation air supply must be from fresh air uncontaminated with flammables, toxins, etc.

Evaluate the Space:

- Determine that the space meets all the conditions set forth in the non-permit justifications,
- Conduct atmospheric testing,
- Evaluation must be certified by entry supervisor's signature, and
- Determine that the confined space does not:
  - ✓ Contain or have the potential to contain a hazardous atmosphere:
    - o Continuous mechanical ventilation not acceptable as good atmosphere.
  - ✓ Contain a material with the potential for engulfment,
  - ✓ Has an internal configuration which could trap or asphyxiate, or
  - ✓ Contain any recognized serious safety or health hazard.

Enter the Space and Proceed with Work:

If non-permit conditions change during the job, the space shall be immediately evacuated and re-classified as a permit required confined space or conditions shall be returned to non-permit conditions and again certified as such by the entry supervisor.

Contractor Confined Space Entry:

- Contractors must be informed of the hazards within the space:
  - ✓ Contractors must follow their own established confined space entry procedure and use their own permit forms, and
  - ✓ Contractors must supply their own attendants:
    - o One attendant is acceptable for multiple companies' entrants.
- Contractors must supply their own air monitors, and
- Contractors must review entry after completion of job.

Attendant Responsibilities:

- Monitor entrants during the job and during entry and exit to help insure their safety,
- May not abandon his post for any reason while personnel are in the space unless relieved by another qualified attendant,

- Monitor atmospheric conditions in the space prior to and during entry,
- Control access to the confined space,
- Summon emergency assistance as needed,
- Assess hazards in and around the space and take action on the same, and
- Keep records of confined space work:
    - ✓ Air test results, and
    - ✓ Personnel entry and exit, etc.

Entrant Responsibilities:

- Assure that the space has been adequately ventilated, isolated, emptied, or otherwise made safe for entry,
- Immediately exit a space, without question, upon word of the attendant, no matter what the reason,
- Follow all safety rules and procedures that apply to the job,
- Be familiar with the work to be performed and the procedures that apply to the job, and
- Use the appropriate PPE whenever necessary.

Supervisor Responsibilities:

- Assure adequate protection is provided to the entrants by verifying adequate lockout/tagout and that all hazards are securely isolated,
- Support the attendant's authority in controlling access to a confined space,
- Verify that all personnel have exited prior to closing the space, and
- Assure that all personnel involved are aware of the hazards associated with the space.

ALWAYS ASSURE THAT RESCUE SERVICES ARE AVAILABLE PRIOR TO ENTRY.

CONTROL OF HAZARDOUS ENERGY SOURCES

OSHA STANDARD 29 CFR 1910.147

This standard requires employers to develop and use an energy control program. The program must include step-by-step procedures for affixing lockout or tagout devices to prevent unexpected energization, start up or release of stored energy which could cause injury to employees. This procedure establishes the minimum requirements for the lockout of energy sources excluding small capacity snap switches near machines and in plan sight to protect employees from unexpected energized start-up or release of stored energy that could occur and cause injury. All potentially hazardous energy shall be isolated and locked out. Kentucky OSHA standard has determined that lockout is a surer means of ensuring de-energization of equipment than tagout, and that lockout is required when achievable.

Each employee needs to know the hazards of unexpected equipment energization, understand that lockout prevents injuries and death and that powered machines and equipment are dangerous if they start up unexpectedly. Equipment may store energy in many forms including:

Electrical		Springs
Mechanical	or	Steam
Hydraulic	in	Air pressure
Pneumatic		Liquids

Employees, working on equipment they believe has been shut off, can be seriously injured when performing tasks such as:

- Cleaning,
- Checking mechanical or operation problems, and
- Repair and maintenance.

Take action to prevent accidental energization. Before working on powered equipment, you must:

- Turn it off and lock the power,
- Release, drain and lockout any stored energy, and
- Take action to prevent accidental energization:
  - ✓ Lockout prevents accidental energization.

The employers Lockout/Tagout procedures must include:

- Preparation for shutdown,
- Equipment isolation,
- Lockout/Tagout application,
- Release of stored energy,
- Verification of isolation, and
- Training for authorized, affected and other employees.

EMPLOYEE CLASSIFICATIONS

Authorized employee is the person who locks out the machine in order to service or perform maintenance under lockout. An affected employee whose duties include performing, servicing or maintenance is also covered under this classification and need special training and authorization to perform lockout. The authorized employee is trained to:

- Recognize hazardous energy sources and their types and amounts,
- Isolate and control energy to prevent accidents, and
- Perform OSHA's specific required lockout steps.

Affected employee is the person whose job required him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or whose job requires the employee to work in an area in which such servicing or maintenance is being performed. The affected employee must know:

- Why lockout is important and how it works,
- The requirement of lockout of equipment before performing repairs or service, and
- The importance of not trying to start equipment or remove or work around locks.

Other employee is a person who might be exposed to a machine that never works or operates it. A good example is office personnel or company accountant. Other employees must understand:

- Lockout basic procedures, and
- The importance of not trying to restart locked out equipment.

EQUIPMENT

The lock "locks" the device in an "off" position so it cannot be restarted. OSHA sets standards for lockout locks and tags. These locks and tags must be:

- Used only for lockout/tagout,
- Durable enough for the jobs length and conditions (temperature/humidity),
- Standardized so all facility lockout/tagout locks and tags are the same color, shape and size,

- Strong enough to be removed only by heavy force or tools like a bolt cutter,
- Identified with the name of the employee who installs and removes it,
- Legible, even if they get dirty or damp,
- Padlock shafts with ¼" diameters. Each authorized employee shall be issued his/her own lock(s) solely for this purpose,
- Multiple lock tongues are to be provided in case jobs call for more than one lock,
- Danger tags for locking out purposes. A "do not use" will be used during shut down periods when plant wide maintenance is being performed, and
- Valve handle locks on occasions, it might be necessary to use a locking device for valve handling controlling steam, acids, caustics, etc. In these cases, tags plus a small chain and lock arrangement will be used.

If the above handle locks are impractical, a suitable metal blank shall be inserted in the line.

LOCKOUT/TAGOUT PROCEDURES

The following is a general guideline for a Lockout/Tagout program. It is the responsibility of the employer to develop a program specific to each facility.

Training and Responsibilities:

- All authorized and affected employees shall be instructed in the safety significance of the lockout procedures by their supervisor. Each new or transfer employee shall receive the same instruction.
- It shall be the basic duty of each employee and supervisor to administer this locking and containing procedure.
- It shall also be the supervisor's responsibility to administer the same procedures in other situations such as testing and research.
- It shall be the responsibility of the operator to inform his/her relief of the lockout of any equipment.

Procedures shall be developed for:

- Electrical circuits,
- Electric switches (excluding small capacity snap switches near machines and in plain sight),
- Electrically operated moving machinery such as machine tools, motor driving compressors and pumps. Where it is impractical to lockout a

chemical pump motor, suitable metal blanks or valve handle devices should be used.

- Closed or partially enclosed vessels. Where personnel should have to enter tanks of any kind, allied pump motors shall be locked and existing pipelines to the vessels shall have valves locked closed or be blanked or disconnected (follow vessel entry procedures).
- Non-electrical power sources, hydraulic or pneumatic systems, for example, and
- Any other condition that would result in the accidental release of stored energy.

Equipment Requirements:

- <u>Locks:</u> and
  - ✓ Locks shall be issued to all affected employees,
  - ✓ None shall be keyed alike,
  - ✓ A number of multiple lock tongues shall be kept in each department for jobs involving more than one person,
  - ✓ These locks are to be used only for the purpose of de-energizing circuits or allied situations in which the potential movement of parts or materials must be made inoperative. In cases where live circuits must be traced for trouble, etc., locks need not be used. However, tags of <u>danger</u> or <u>men at work on line</u> must be placed strategically on the line or equipment,
  - ✓ Under no circumstance will anyone use a lock other than the one issued to him or her (except as noted below),
  - ✓ All electrical switching shall be examined and made easy to lockout. If lockout of disconnect handle is not possible the fuses will be pulled and a tag placed at the disconnect denoting time of disconnect and who removed the fuses,
  - ✓ Should a job having a lock be carried over past a shift change and the shifts do not overlap, or if it is to be some time before the switch will be closed again, the person relieving shall place his lock on the lockout as the relieved person takes his off, and
  - ✓ **It should be stressed that an incomplete job should always be locked out.**
- <u>Keys</u>:
  - ✓ Each person shall be responsible for his/her own key,
  - ✓ If one key is lost the old lock will not be used for locking out and will be replaced, and
  - ✓ Damaged keys and locks will be returned and replaced.

Lockout Procedure – Sequence of Events:

1. Notify all affected employees that a lockout is required and the reason for it.
2. If the equipment is operating the operator will shut down by the normal stopping procedure (depress stop button, open toggle switch, etc.).
3. The employee on the job will operate the switch, valve or other energy-isolating device so that each energy source (electrical, mechanical, hydraulic, etc.) is disconnected or isolated from the equipment. Stored energy (such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, air and gas, steam or water pressure, etc.) must be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.
4. The employee(s) doing the work will lockout the energy isolating devices with an assigned individual lock.
5. After ensuring that no personnel are exposed, and as a check on having disconnected the energy sources, operate the push button or other normal operating controls to make certain the equipment will not operate.
6. **Caution: return operating controls to neutral or "off" position after the test!**
7. The equipment is now locked out.
8. Each department shall maintain a lockout log, which shall contain the date, time, job and employee (see attached sample).

Restoring Equipment to Service:

1. When the job is complete and equipment is ready for testing or normal service, check the equipment area to see that no one is exposed.
2. When the equipment is all clear, each employee will remove his/her lock. The energy isolating devices may be operated to restore energy to equipment.
3. Notify all employees that equipment has been re-energized and is ready to operate.

General Provisions:

1. It is to be stressed that this procedure is only a protective device. It shall be reviewed thoroughly with the people involved by a supervisor and a member of the safety department.
2. Each person involved shall have a copy of the lockout procedure.
3. Lock and keys will be checked annually by the maintenance/safety supervisor.

STUDY GUIDE
SAFETY

1. Safe operation of a landfill is only possible with the complete cooperation of ________________________________.

2. A safe workplace is one in which hazards are ________________ and ________________ and workers are ________________ in proper procedures to manage those hazards.

3. National Safety Council statistics indicate that injuries in the refuse industry are ____ times national injuries for other industries.

4. More than ___ percent of all accidents are caused by unsafe acts.

5. OSHA requires that employees be made ___________ of the hazards and _______ to respond to those hazards.

6. Safe operations benefit the landfill owner, manager and operator. Benefits to the owner and manager of the landfill include:

   ____

   ____

   ____

7. List the four components of the operation safety program:

   ____

   ____

   ____

   ____

8. The three broad categories of hazards encountered at a landfill site are:

   ____________________ _________________________ ____________________

9. The MSDS Notebook should be accessible to _____ _________ for all chemicals _______, __________ _____ or ______________ at the landfill.

10. An employee has the ________-____-_______ what hazardous materials are on work-site and trained to work safely with those materials.

11. The primary ways workers are exposed to hazardous chemicals include:

____

____

____

12. List ways an employee can increase protection from physical hazards.

____

____

____

____

13. Every equipment operator should receive thorough ___________ on the _________ use of his or her equipment.

14. List pieces of operator protective equipment and the reasons for wearing them:

____

____

____

____

____

____

15. List possible sources of biological hazards at a landfill facility.

____

____

____

16. List ways to protect yourself from exposure to biological hazards.

____

____

____

____

17. List the four types of fire extinguishers and what they are used for:

____

____

____

____

18. At least one person at the site should have a ______ _____ ______________.

19. Equipment and buildings should have properly stocked ___________ _________ __________ that are checked regularly and restocked as needed.

20. OSHA estimates that compliance with the permit-required confined space standard could reduce fatalities, injuries, and illnesses by _____ percent.

21. List the three levels of training for confined space entry and their duties.

____

____

____

22. Under Kentucky OSHA Standards, any device that can be locked out must be locked out. **TRUE-FALSE**

23. List the three levels of training for lockout/tagout and their duties:

____

____

____

24. ____________ _______________ should be trained to look for unsafe conditions or actions and report them so they can be corrected.

25. Safety rules should be posted at the _____________ **of the landfill** and at other visible locations.

26. Safety training programs must be used to _____________ the hazards at each facility.

27. Safety training programs for a landfill should include training programs for:

____

____

____

____

ACRONYMS USED IN THIS MANUAL

ADC---------alternative daily cover
BOD---------biochemical oxygen demand
CFR---------Code of Federal Regulations
C/D/D-------construction/demolition/debris
CERCLA---Comprehensive Environmental Response, Compensation and Liability Act
COD---------chemical oxygen demand
CPR----------cardiopulmonary resuscitation
DOT----------Department of Transportation
EHS----------extremely hazardous substance
EPA----------Environmental Protection Agency
EPCRA------Emergency Planning and Community Right-to-Know Program
ERP----------emergency response plan
ERT----------emergency response team
FD------------fire department
FML----------flexible membrane liner
HDPE--------high density polyethylene
HELP--------hydrologic evaluation of landfill performance
IDLH--------immediately dangerous to life and health
KAR---------Kentucky Administrative Regulation
KPDES------Kentucky Pollutant Discharge Elimination System
KRS---------Kentucky Revised Statute
LDPE--------low density polyethylene
LEL----------lower explosive level
LEPC--------local emergency planning committee
LF------------landfill
LULU--------locally unacceptable land use
MEK---------methyl ethyl ketone
MRF---------materials recovery facility
MSDS--------materials safety data sheet
MSHA-------Mine Safety and Health Administration
MSW---------municipal solid waste
NIOSH-------National Institute of Occupational and Safety Health
NOI-----------Notice of Intent
NOV----------Notice of Violation
NRC----------National Response Center
OSHA--------Occupational Safety and Health Administration
PCB-----------polychlorinated biphenyl
PEL-----------permissible exposure level
PETE---------polyethylene terephthalate
pH------------negative logarithm of hydrogen ion concentration
POTW-------publicly owned treatment works
PP------------polypropylene
PS------------polystyrene

PURPA------Public Utility Regulation and Policy Act
PVC----------polyvinyl chloride
QA/QC-------quality assurance/quality control
RCLA---------Resource Conservation and Local Assistance
RCRA--------Resource Conservation and Recovery Act
RDF-----------refuse derived fuel
RQ-------------reportable quantity
SARA---------Superfund Amendments and Reauthorization Act
SERC----------state emergency response coordinator
SIC-------------standard industrial code
SVOC---------semi-volatile organic compound
TCLP----------toxicity characteristic leaching procedure
TDS------------total dissolved solids
TLV------------threshold limit value
TOC------------total organic carbon
TPQ------------threshold planning quantity
TQM-----------total quality management
TSS-------------total suspended solids
VOC------------volatile organic compound

GLOSSARY

ACRE: Unit for measuring land, equal to 43,560 square feet, 4,840 square yards; or 160 square rods.

AERATION: The process of exposing something to air or charging a liquid with gas.

AEROBIC: Bacteria, which require the presence of free (dissolved or molecular) oxygen for their metabolic processes. Oxygen in chemical combination will not support aerobic organisms.

AGGREGATE: Crushed rock or gravel screened to sizes for use in road surfaces, concrete, or bituminous mixes.

AGRICULTURAL WASTE: Waste materials produced from the raising of plants and animals for food. These materials include such things as animal manure, plant stalks, hulls and leaves.

AIR POLLUTION: The presence of contaminants in the air to such a degree that the normal self-cleansing or dispersive ability of the atmosphere cannot cope with them.

ALKALINITY: A quantitative measure of the capacity of liquids or suspensions to neutralize strong acids or to resist the establishment of acidic conditions. Alkalinity results from the presence or bicarbonates, carbonates, hydroxides, volatile acids, salts, and occasionally of borate's, silicates and phosphates. Numerically, it is expressed in terms of the concentration of calcium carbonates that would have an equivalent capacity to neutralize strong acids.

ALGAE: Plants found in sunlit situations on land, as well as in fresh and salt water over a wide range of latitude, grow as individual cells, small clumps, or as large masses.

ANAEROBIC: Bacteria that do not require the presence of free or dissolved oxygen for metabolism. Strict anaerobes are hindered or completely blocked by the presence of dissolved oxygen and in some cases by the presence of highly oxidized substances such as sodium nitrates and perhaps sulfates.

ANGLE OF REPOSE: The maximum angle at which the inclined surface of a pile of loosely divided material can make with the horizon.

AQUIFER: A geologic formation, group of formations, or part of .a formation capable of yielding a significant amount of groundwater to wells or springs.

ASHES: The residue from the burning of wood, coal, coke, and other combustible material.

BACKEND LOADER (REFUSE TRUCK): A compactor truck, which has its power-driven, loading equipment at the rear, behind the body.

BACKFILL: The material used in refilling a ditch or other excavation or the process of such refilling.

BACKHOE: A mechanical hoe or pull shovel.

BACTERIA: Single-celled organisms, microscopic in size, which possess rigid cell wails and when moving have flagella. The cell nucleus is not surrounded by a membrane. There are three major groups: true bacteria, actinomycetes, and budding bacteria. Some are capable of causing human, animal, or plant diseases. Some are important in sewage or refuse stabilization.

BEARING CAPACITY: Maximum ability of a material, to support an imposed load, before failure.

BEDROCK: The solid rock underlying soils and the mantle rock or exposed rock at the surface without a cover.

BENCH MARK: A point of known or assumed elevation used as a reference in determining and recording other elevations.

BERM: An artificial ridge of earth.

BIODEGRADABLE: Waste material that is capable of being broken down by bacteria into basic elements. Most organic waste, such as food remains and paper, is biodegradable.

BIO-CHEMICAL OXYGEN DEMAND (BOD): A measure of the amount of oxygen used by microorganisms to break down organic waste materials in water.

BITUMINOUS: Containing asphalt or tar.

BLADE: Steel plate, concave in vertical plane, affixed to a tractor used for excavation and spreading.

BLADE (SANITARY LANDFILL): A U-blade with extension fabricated on top to increase volume of solid waste that may be pushed and spread.

BLADE (U): A dozer blade with-extension on both sides, protruding forward at an obtuse angle to the blade, enabling handling of a larger volume of solid waste.

BLUE TOPS: Grade stakes whose tops indicate finished grade level.

BORING: Rotary drilling.

BORROW PIT: An excavation from which material is taken to a nearby job.

BOULDER: A rock that is too heavy to be lifted readily by hand.

BUCKET: An open container affixed to movable arms of a loader to move and spread solid waste and soil and also to excavate soil.

BULKY WASTE: Large items of refuse, such as appliances, furniture, large auto parts, trees and branches, palm fronds, stumps, foliage, etc.

BULLDOZER: A tractor equipped with a front pusher blade.

BURNER, REFUSE: A device for either municipal or on-site volume reduction of refuse by burning and of simple construction, not to be confused with incinerator, which, properly designed and operated, can produce an acceptable emission and residue.

CARBON DIOXIDE: An odorless, tasteless, colorless, and nonpoisonous gas. One source is from sanitary landfills undergoing aerobic and/or anaerobic microbial decomposition, which is highly soluble in water, forming carbonic acid.

CARBON MONOXIDE (CO): A colorless gas characterized by an exceedingly faint metallic odor and taste. It is extremely poisonous, inducing asphyxiation. As much as 0.2% in air is poisonous and 0.43% will induce asphyxiation.

CELL: The volume of compacted solid waste enclosed in a portion of a landfill which is isolated, usually by means of an approved barrier.

CELL DEPTH: Vertical thickness of compacted solid waste enclosed in a portion of a landfill which is isolated, usually by means of an approved barrier.

CELL THICKNESS: Perpendicular distance between cover material placed over the last working faces of two successive cells in a sanitary landfill.

CHIPPER: A size reduction device relying primarily on me shearing, cutting, or chipping action produced by sharp-edged blades attached to a rotating shaft (mandrel) which shaves or chips off pieces of the charged object.

COLLECTION: The act of picking up waste materials at hordes, businesses, or industrial sites, usually with an enclosed truck, and hauling it to a facility for further processing or action.

COMBUSTIBLES: Various materials in the waste stream which are burnable, in general, these are organic in nature; paper, plastics, wood and food wastes.

COMMERCIAL SOLID WASTE: Waste material which is generated by stores, offices, restaurants, warehouses, and other service and non manufacturing activities, excluding household and industrial solid waste.

COMMUNICABLE DISEASE: An illness due to an infectious agent or its toxic products which is transmitted directly or indirectly to a well person from an infected person or animal, or through the agency or an intermediate host, vector, or inanimate environment.

COMPACTION: Reduction in bulk of fill by rolling and tamping.

COMPACTOR: Any power driven mechanical equipment designed to compress and, thereby, reduce the volume of waste materials.

COMPACTOR TRUCK: A large truck with an enclosed body having special power driven equipment for loading, compressing and distributing waste materials within the body.

COMPOST: A type of solid waste which has undergone biological decomposition of organic matter, been disinfected using composting or similar technologies, been stabilized to a degree which is potentially beneficial to plant growth and which is approved for use or sale as a soil amendment, artificial topsoil, growing medium amendment, or other similar uses.

CONSTRUCTION MATERIALS: Non-hazardous, non-soluble material, including but not limited to steel, concrete, brick, asphalt roofing material, or lumber from a construction or demolition project. Mixture of construction and demolition debris with any amount of other types of waste may cause it to be classified as other than construction materials.

COVER MATERIAL: Soil or other suitable material that is spread and compacted on the top and side slopes of disposed waste in order to control disease vectors, gases, erosion, fires, and infiltration of precipitation or run-on; support vegetation; provide trafficability; or assure aesthetic appearance.

CRUSHER: A mechanical device used to break up waste material into smaller sized pieces by a pounding action (hammers or beaters).

CULLET: Scrap glass, usually broken up into small, uniform pieces.

DECOMPOSITON: The breakdown of organic waste materials by bacteria. Aerobic process refers to one using oxygen breathing bacteria, while anaerobic refers to a process using bacteria, which breathe an inorganic oxidant. Total decomposition leaves only carbon dioxide, water and inorganic solids. Decomposition occurs spontaneously in the open (dumps and landfills) or can be harnessed in waste treatment equipment to work under controlled conditions.

DEMOLITION WASTE: Waste materials produced from the destruction of buildings, roads, sidewalks, etc. The materials usually include large broken pieces of concrete, pipe, radiators, ductwork, electric wire, broken up plaster walls, lighting fixtures, bricks and glass.

DENSITY: The ratio of the weight of a substance to its volume.

DEPTH OF FILL: Total distance between undisturbed earth or bottom of solid waste in the sanitary landfill and top of final cover material.

DESIGN RUNOFF RATE: Maximum runoff rate (occurring expected) in a given period of time, during and immediately following rainfall.

DEWATERING: The removal of water by filtration, centrifugation, pressing, open air-drying of other methods. Dewatering makes sewage sludge suitable for disposal by burning or landfilling. The term is also applied when removing water from pulp.

DIGESTER: Specially designed equipment in which waste materials are softened or decomposed, usually for further processing.

DIKE: An embankment or ridge of either natural or plan-made materials used to prevent the movement of liquids, sludges, solids or other materials.

DISPOSAL, ONSITE: Includes all means of disposal of refuse on premises before collection. Examples are: garbage grinding, burning, or incineration, and burial.

DISTILLATION: A separation process used to remove water from waste materials in some treatment or recovery systems. The water is vaporized, removed from the unit and condensed back into a liquid.

DISPOSAL: The discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment, be emitted into the air, or be discharged into any water, including groundwaters.

DUMP: An open land site where waste materials are burned, left to decompose, rust, or simply remain. In most localities, dumps are being phased out because of the problems they cause, such as water pollution, creating of unsanitary conditions and general unsightliness. Some dumps are left burning as waste is accumulated. This practice does not lend itself to control and, therefore, very little of the waste is actually consumed by fire. The burning also generates obnoxious smoke, fumes and ash particles.

ECOLOGY: A branch of science concerned with the interrelationship of all animals, plants, insects and other organisms and their environment.

EFFLUENT: Any solid, liquid, or gas which enters the environment as a by-product of man-oriented processes.

EMISSIONS (GASEOUS): Waste gases released into the atmosphere as the product of combustion.

ENERGY RECOVERY: One of the concepts of resource recovery where a part, or all, of the waste materials going into a recovery facility are burned to produce heat which can be used to produce steam for heating or for the generation of electricity.

ENVIRONMENT: The air, the water and the earth, sometimes called the biosphere.

ENVIRONMENTAL PROTECTION AGENCY (EPA): An agency of the Federal Government, formed in 1970, which has the responsibility for ensuring that governmental, residential, commercial and industrial waste disposal activities do not adversely impact the physical environment.

EROSION, SOIL: The wearing away of the land surface normally by wind or running water.

EVAPO-TRANSPIRATION: The sum of water removed by vegetation and that lost by evaporation for a particular area during a specified time.

FERROUS: Metals which are predominantly composed of iron. In me waste stream, these usually include cans, automobiles, old refrigerators, stoves, etc.

FILTER: A device through which a liquid or gas is passed in order to remove small particles or dust.

FLY ASH: Small solid particles of ash and soot generated when burning coal, oil or waste materials. With proper equipment, fly ash is collected before getting into the atmosphere. Fly ash residue can be used for building materials (bricks) or in a sanitary landfill.

FOSSIL FUELS: Fuels, such as coal, oil and natural gas, which are the remains of ancient plant and animal life.

FRONTEND LOADER (REFUSE TRUCK): A compactor truck which has its power driven loading equipment at the front; ahead of the cab.

GARBAGE: Waste materials which are likely to decompose or putrefy and usually contain food wastes from a kitchen, restaurant, grocery store, slaughter house or food processing plant.

GASES: Normally formless fluids which occupy the space of enclosure and which can be changed to the liquid or solid state only by the combined effect of increased pressure and deceased temperature.

GOVERNING BODY: The body responsible for implementation of the area solid waste management plan and review of permit applications to construct or expand municipal solid waste disposal facilities. This review is to determine if the application is consistent with the plan.

GRADER: A gas or diesel pneumatic wheel machine equipped with a centrally located blade that can be angled to cast to either side, with independent hoist control on each side.

GRAVITY SEPARATION (FLOTATION, HEAVY MEDIA): The collection of substances immersed in a liquid by taking advantage of differences in specific gravities. In solid waste recovery, this process enables separation of the various non-ferrous metals from other heavy materials.

GRINDER: A mechanical device used to pulverize waste material into powder or small particles by a friction action (I.E., by rubbing between two hard surfaces).

GRINDING (GARBAGE): A method of uniformly breaking food waste or garbage into small pieces or particles. The grinding device may be in a home sink unit or a large central grinder which serves industry or the community. Home units are usually flushed with water into the sanitary sewer.

GROUND WATER: Water which is in a zone of saturation. It is differentiated from water held in the soil, from water in downward motion under the force of gravity in the unsaturated zone, and from water held in chemical or electrostatic bondage.

GROUSER: A ridge or cleat across a track shoe mat improves its grip on the ground.

HAMMERMILL: A mechanical device that is used to break up waste materials into smaller pieces or particles by using a system of heavy rotating hammers.

HARDPAN: Hardened; compacted or cemented soil horizon.

HAUL DISTANCE: (a) Distance which covered material must be transported to the working face. (b) Distance collection truck must travel from its last pick-up stop to the working face or a sanitary landfill or tipping floor of a solid waste volume reduction or disposal facility. (c) Distance transfer vehicle must travel from solid waste processing station to point of final disposal.

HAUL, TIME: Elapsed or cumulative time spent hauling collected refuse from the route or from transfer station to the disposal point

HAZARDOUS WASTE: As defined in 401 KAR 31:010, Section 3.

HOUSEHOLD SOLID WASTE: A type of solid waste including garbage and trash generated by single and multiple family residences, hotels, motels, bunkhouses, ranger stations, crew quarters, and recreational areas such as picnic areas, parks, and campgrounds.

INCINERATOR: An enclosed device using controlled flame combustion, the primary purpose of which is to thermally break down waste. Examples of incinerators are: rotary kiln, fluidized bed, and liquid injection incinerators.

INDUSTRIAL SOLID WASTE: Those solid waste materials generated by manufacturing or industrial processes that are not a hazardous waste or a special waste, including wastes resulting from manufacturing processes.

JUNK: Waste materials, such as brass, rags, paper or metals. The term usually implies that the materials can be recovered for reuse or converted to usable stock.

LEACHATE: A liquid containing decomposed waste, bacteria and other dangerous materials that drains out of landfills and must be collected and treated so as not to contaminate water supplies, rivers or streams.

LITTER: That highly visible portion of solid waste, generated by the consumer and carelessly discarded outside of the regular disposal system. Litter accounts for about only 2 percent of the total solid waste volume.

LOAM: A soft, easily worked soil containing sand, salt, and clay.

MANUAL SEPARATION: The separation of waste materials by hand. Sometimes called hand picking, manual separation is done in the home or office by keeping garbage separate from newspapers, or in a recovery plant by picking out large cardboard or metal objects.

MATERIALS RECOVERY: One of the concepts of resource recovery where the emphasis is on collecting, separating and processing waste materials to be sold for various purposes. Materials include paper, glass, metals, plastics, etc.

METHANE: An odorless, colorless, flammable gas which can be formed by me decomposition of organic waste matter. It is also produced by the carbonization of coal and used as fuel.

MICROORGANISMS: Generally, any living thing microscopic in size and including: bacteria, yeast's, simple fungi, some algae, slime molds and protozoa's. They are involved in stabilization of waste materials (composting) and in sewage treatment processes.

MIXED PAPER: Waste paper of various kinds and quality usually collected from stores, offices and schools.

MUNICIPAL SOLID WASTE: The combined residential and commercial waste materials-generated in a given municipal area. The collection and disposal of these wastes are usually the responsibility of local government.

NEWSPRINT: The kind or type of paper generally used for printing newspapers.

NON-FERROUS: Metals which contain no iron. In waste materials, this is usually aluminum, copper wire, brass, bronze, etc.

OPEN BURNING: The combustion of any material without: (a) Control of combustion air to maintain adequate temperature for efficient combustion; (b) Containment of the combustion reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion; and (c) Control of emission of the gaseous combustion products.

ORGANIC MATTER: Chemical compounds of carbon combined with other chemical elements and generally manufactured in the life processes of plants and animals. Most organic compounds are a source of food for bacteria and are usually combustible.

PARTICULATES: Small particles of liquid or solid material.

PERCOLATION: A qualitative term applying to the downward movement or water through soil.

PERMEABILITY (QUALITATIVE): The quality or state of a porous medium relating to the readiness with which it conducts or transmits fluids.

POLLUTION: The presence in a body of water (or soil or air) of substances of such character and in such quantities that the, natural quality of the body of water (or soil or air) is degraded so it impairs the water's usefulness or renders it offensive to the senses of sight, taste, or smell. Contamination may accompany pollution. In general, a public health hazard is created, but in some cases only economy or esthetics are involved as when waste salt brines contaminate surface waters and when foul odors pollute the air.

PRECIPITATION: The physical or chemical separation of a solid substance from solution. The separation is usually induced, such as in waste treatment process equipment

PRIMARY MATERIALS: Virgin or new materials used for manufacturing, basic products. Examples include wood pulp, iron ore and silica sand.

PRIVATE UTILITY: A firm providing service under a government license or monopoly franchise to collect, transport, process or dispose of waste materials.

PUTRESCIBLE: Susceptible to rapid decomposition by bacteria, fungi, or oxidation sufficient to cause nuisances such as odors, gases, or other offensive conditions.

RECLAMATION: The restoration to usefulness or productivity of materials found in the waste stream. The reclaimed materials may be used for purposes which are different from their original usage.

RECYCLING: Separating a given waste material (e.g., glass) from the waste stream and processing it so that it may be used again as the raw material for products which may, or may not be similar to the original.

REFUSE: A generally used term for solid waste materials.

RESIDENTIAL WASTE: Waste materials generated in houses and apartments. The materials include paper, cardboard, beverage and food cans, plastics, food wastes, glass containers and garden wastes.

RESIDUE: The solid materials remaining after completion of a chemical or physical process, such as burning, evaporation, distillation or filtration.

RESOURCE RECOVERY: The process by which material subject to the waste management regulations which still have useful physical or chemical properties are reused or recycled for the same or other purposes, including uses as an energy source.

RUBBISH: Waste materials, usually of a generally undefined nature.

RUBBLE: Waste materials made up mainly of fragments or pieces of rock or masonry. Sometimes containing lumber or other construction materials.

RUNOFF: Any rainwater, leachate or other liquid that drains overland from any part of a facility.

SALVAGING: The controlled removal, of waste materials for utilization in a manner approved by the department.

SANITARY LANDFILL: A solid waste disposal facility permitted for the disposal of solid waste which complies with the "Environmental Performance Standards" specified in 401 KAR 47:030.

SCAVENGING: The removal of waste materials from a waste management facility site in a manner deemed by the department to be dangerous to the health and safety of any person.

SCRAP: Waste material which is usually segregated and suitable for recovery or reclamation.

SECONDARY MATERIALS: Uniformly segregated and processed waste materials from a recycling plant which are sold to manufacturers for use in making basic products. For example, waste glass is turned into clean, uniform pieces of broken glass (cullet) which is sold to glass bottle manufacturers.

SEEPAGE: Movement of water through soil without formation of definite channels.

SEPARATION: To divide waste into groups of similar materials, such as paper products, glass, food wastes and metals. Also, used to describe the further sorting of materials into more specific categories, such as clear glass and dark glass. Separation may be done manually or with specialized equipment

SHALE: A rock formed of consolidated mud.

SHREDDER: A mechanical device used to break up waste materials into smaller pieces. The pieces are usually in the form of irregularly shaped strips.

SLOPE: Degree of deviation of a surface from the horizontal usually expressed in percent or degrees.

SLUDGE: Any solid, semi-solid, or liquid waste generated from a municipal, commercial, or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility exclusive of me treated effluent from a wastewater treatment plant or any other such waste having similar characteristics and effects.

SPOTTER: In truck use, the man who directs the driver into loading or dumping position.

STAKE, SLOPE: A stake marking the line where a cut or fill meets the original grade.

STOCKPILE: Material dug and piled for future use.

SUBSOIL: That part' of the soil beneath the topsoil, usually not having an appreciable organic matter content.

SURFACE WATER: A body of water whose top surface is exposed to the atmosphere including a flowing body as well as a pond or lake.

SURVEYING: To find and record elevations, locations, directions, by means of instruments.

TOPSOIL: The topmost layer of soil, usually refers to soil containing humus, which is capable of supporting a good plant growth.

TOPOGRAPHIC MAP: A map indicating surface elevation and slope.

TRACK: A crawler track.

TRACK, CRAWLER: One of a pan- of roller chains used to support and propel a machine. It has an upper surface which provides a track to carry the wheels of the machine, and a lower surface providing continuous ground contact.

TRACK, ROLLER: In a crawler machine, the small wheels which are under the track frame and rest on the track.

TRACTOR LOADER (TRACTOR SHOVEL OR SHOVEL DOZER): A tractor equipped with a bucket, which can be used to dig and to elevate to dump at truck height.

TRACTOR, PNEUMATIC WHEEL: A gas or diesel powered machine equipped with four pneumatic tires, used to spread, excavate and compact soil and solid waste.

TRACTOR, TRACK: A gas or diesel powered machine equipped with continuous roller belt over cogged wheels for moving over rough or low bearing capacity terrain, used to spread, excavate and compact soil and solid waste.

TRASH: Waste materials which usually do not include garbage but may include other organic materials, such as plant trimmings.

UNIVERSAL COLLECTION: A municipal solid waste collection system which is established by ordinance arid approved by the Cabinet and requires access for each household or solid waste generator in a county.

URBAN WASTE: A general term used to categorize the entire waste stream from an urban area. It is sometimes used in contrast to "Rural Waste."

VIRGIN MATERIAL: Any basic material from industrial processes which has not previously been used. For example, wood pulp trees, iron ore, silica sand, crude oil, bauxite.

WATERSHED: Total land area above a given point on a stream or waterway that contributes runoff to that point

WATER TABLE: The surface of underground, gravity-controlled water.

WORKING FACE: That portion of the compacted solid waste at a sanitary landfill, which will have more waste placed on it and/or is being compacted prior to, placement of cover material.